

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-076726

(43)Date of publication of application : 15.03.2002

(51)Int.Cl.

H01P 5/16

H01P 5/18

H01P 5/22

(21)Application number : 2000-261363 (71)Applicant : MITSUBISHI ELECTRIC CORP

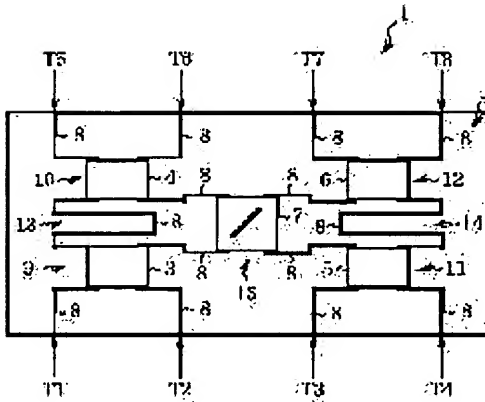
(22)Date of filing : 30.08.2000 (72)Inventor : INOUE MAYUMI
KODAMA MAKOTO
ISODA YOJI
KAWAKAMI KENJI

(54) BATLER MATRIX

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a batler matrix that solves problems of electric characteristics, low reliability in mounting, expensiveness and a complicated manufacturing process.

SOLUTION: First to fifth small dielectric boards 3-7 of a single-layered structure are mounted on an upper face 2a of a main dielectric board 2 of the single layer structure by a flip chip bonding method. Then, first to fourth hybrid parts 9-12 and a line intersection part 15 are comprised.



*** NOTICES ***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention is constituted using a hybrid and a fixed phase shifter, changes the phase of the signal outputted from each outgoing end according to the input edge of a signal, and relates to the Butler matrix which controls the sense of the wave front formed by the signal outputted from each outgoing end.

[0002]

[Description of the Prior Art] By rapid increase of a pocket device in recent years, radio equipment, etc., the demand of the formation of small lightweight of a mounting substrate and attenuation prevention of the signal in a RF, the reduction in a noise, etc. becomes strong quickly, and these realization serves as pressing need especially in the millimeter wave band. In order to meet these demands, the mounting method of IC chip is also changing to a flip chip method from the conventional wirebonding. this flip chip method -- connection -- public funds -- it is the mounting method which carries out the direct file of a chip and the substrate through a group (bump)

[0003] The flip chip mounting method has the feature that the large formation of many pins with a small circuit area is possible, compared with the wirebonding mounting method which connects using a golden wire etc. Furthermore, since the connection length of a chip and a substrate can be sharply shortened compared with the conventional wirebonding mounting method, there is an advantage which the inductance of a connection can be made small and can suppress dispersion at the time of machining.

[0004] These are indicated by "newest trend [of "high density assembly]", Toray Industries Research center, and February 1, 1998 issue."

[0005] Next, the Butler matrix is explained. Drawing 31 is the plan of the main dielectric substrate which constitutes the conventional Butler matrix announced by "the Showa Institute of Electronics and Communication Engineers synthesis national conference in the 59 fiscal year." Drawing 32 is the cross section of the conventional Butler matrix in the position which met the A-A line of drawing 31 . In drawing the Butler matrix and 202 201 The main dielectric substrate, The upper surface of the main dielectric substrate 202 and 202b 202a The inferior surface of tongue of the main dielectric substrate 202, The 1st dielectric substrate by which 203 has been arranged at the main dielectric substrate 202 bottom, The 2nd dielectric substrate by which 203a had been arranged on the upper surface of the 1st dielectric substrate 203, and 204 has been arranged at the main dielectric substrate 202 bottom, The 1st strip conductor by which 204b was formed in the inferior surface of tongue of the 2nd dielectric substrate 204, and 205 was formed in

upper surface 202a of the main dielectric substrate 202, the 2nd strip conductor by which 206 was formed in inferior-surface-of-tongue 202b of the main dielectric substrate 202, and the 1st gland where 207 was formed in upper surface 203a of the 1st dielectric substrate 203 -- a conductor and the 2nd gland where 208 was formed in inferior-surface-of-tongue 204b of the 2nd dielectric substrate 204 -- it is a conductor. The dielectric constant of each dielectric substrate is the same.

[0006] A-D -- the 1- the 1- equipped with 4th 90-degree hybrid -- the 4th hybrid section is constituted -- The 1st of the main dielectric substrate 202 - the 4th field, and E constitute the track intersection which a strip conductor intersects. the 1- of the 5th field of the main dielectric substrate 202, and the signal which inputs T1-T4 into the Butler matrix 201 -- the 4th input edge, and T5-T8 are the 1st of the signal outputted from the Butler matrix 201 - the 4th outgoing end the 1- the composition of 4th field A-D is the same. In addition, it is the field which constitutes the fixed phase-shifter section equipped with 45-degree fixed phase shifter between the 1st field A and the 2nd field B and between the 3rd field C and the 4th field D. The Butler matrix 201 is equipped with four and two 45-degree fixed phase shifters for 90-degree hybrid, and a strip conductor crosses by one place.

[0007] Drawing 33 is the enlarged view of the 1st field A of upper surface 202a of the main dielectric substrate 202. Drawing 34 is the enlarged view of the 1st field A of inferior-surface-of-tongue 202b of the main dielectric substrate 202. In drawing 209 The 1st 1/4-wave length section of the 1st strip conductor 205, The 5th input edge of the signal which inputs T9 into the 1st hybrid section, the 6th outgoing end of the signal which outputs T12 from the 1st hybrid section, The 6th input edge of the signal which inputs 210 into the 2nd 1/4-wave length section of the 2nd strip conductor 206, and inputs T10 into the 1st hybrid section, and T11 are the 5th outgoing end of the signal outputted from the 1st hybrid section. The 1st and 2nd 1/4-wave length section 209,210 has one fourth of the length of the wavelength in desired frequency. The signal inputted into the 1st and 2nd input edge T1 and T2 inputs into the 5th and 6th input edge T9 and T10.

[0008] Drawing 35 is drawing which was seen from the direction perpendicular to upper surface 202a of the main dielectric substrate 202 and in which showing the physical relationship of the component of the 1st field A of the main dielectric substrate 202. As shown in drawing 35 , when it sees from a direction perpendicular to upper surface 202a of the main dielectric substrate 202, the 1st and the 2nd strip conductor 205,206 are formed in the main dielectric substrate 202 so that the 1st and 2nd 1/4-wave length section 209,210 may be in agreement. Thus, the tie way is constituted when the 1st and 2nd 1/4-wave length section 209,210 is in agreement.

[0009] Drawing 36 is the enlarged view of the 5th field E of upper surface 202a of the main dielectric substrate 202. Drawing 37 is the enlarged view of the 5th field E of inferior-surface-of-tongue 202b of the main dielectric substrate 202. The input edge of the octavus of the signal which inputs into the 2nd narrow section of the 2nd strip conductor 206 the 7th input edge of the signal which inputs 211 into the 1st narrow section of the 1st strip conductor 205, and inputs T13 into a track intersection, the outgoing end of the octavus of the signal which outputs T16 from a track intersection, and 212 in drawing, and inputs T14 into a track intersection, and T15 are the 7th outgoing end of the signal outputted from a track intersection.

[0010] Drawing 38 is drawing which was seen from the direction perpendicular to upper

surface 202a of the main dielectric substrate 202 and in which showing the physical relationship of the component of the 5th field E of the main dielectric substrate 202. As shown in drawing 38 , when it sees from a direction perpendicular to upper surface 202a of the main dielectric substrate 202, the center of the 1st and 2nd narrow section 211,212 is in agreement, and the 1st and the 2nd strip conductor 205,206 are formed in the main dielectric substrate 202 so that the 1st and 2nd narrow section 211,212 may cross. Thus, combination is suppressed by narrowing width of face for an intersection of the 1st and the 2nd strip conductor 205,206.

[0011] In addition, in a position and b position which are shown in drawing 31 , the 1st strip conductor 205 and 2nd strip conductor 206 are connected by the Bahia hall.

Moreover, stop ****ing, it is alike and the 1st and 2nd dielectric substrate 203,204 is being fixed more to the main dielectric substrate 202.

[0012] thus, the main dielectric substrate 202 by which, as for the conventional Butler matrix 201, the 1st strip conductor 205 was formed in upper surface 202a, and the 2nd strip conductor 206 was formed in inferior-surface-of-tongue 202b -- upper surface 203a -- the 1st gland -- the 1st dielectric substrate 203 in which the conductor 207 was formed, and inferior-surface-of-tongue 204b -- the 2nd gland -- the three-tiered structure inserted by the 2nd dielectric substrate 204 in which the conductor 208 was formed is carried out

[0013] Next, operation is explained. The signal inputted from the 1st input edge T1 is inputted into the 1st hybrid section from the 5th input edge T9. The signal inputted into the 1st hybrid section carries out magnetic field combination through the above-mentioned tie way, and is distributed to the 5th and the 6th outgoing end T11 and T12. 90 degrees of phases are progressing from the signal which outputs the signal outputted from the 5th outgoing end T11 from the 6th outgoing end T12.

[0014] The signal outputted from the 5th outgoing end T11 passes the fixed phase-shifter section, and inputs it into the 2nd hybrid section. The signal outputted from the 6th outgoing end T12 passes a track intersection, and inputs it into the 4th hybrid section.

[0015] When passing the fixed phase-shifter section, 45 degrees of phases are late for the case where a track intersection is passed. Therefore, in order that 90 degrees of signals which output from the 5th outgoing end T11, pass the fixed phase-shifter section, and are inputted into the 2nd hybrid section may progress in the 1st hybrid section and they may be in 45 degrees in the fixed phase-shifter section compared with the signal which outputs from the 6th outgoing end T12, passes a track intersection, and is inputted into the 4th hybrid section, they are united and are progressing 45 degrees.

[0016] The signal which the signal inputted into the 2nd hybrid section was distributed to the 1st outgoing end T5 and 2nd outgoing end T6 like the case where it mentions above, and was inputted into the 4th hybrid section is distributed to the 3rd outgoing end T7 and 4th outgoing end T8 like the case where it mentions above. 90 degrees of phases are progressing from the signal with which a phase outputs the signal which is progressing 90 degrees and is outputted from the 3rd outgoing end T7 from the 4th outgoing end T8 from the signal which outputs the signal outputted from the 1st outgoing end T5 from the 2nd outgoing end T6. Therefore, as for the signal which 45 degrees of phases progress and outputs the signal which 135 degrees of phases progress and outputs the signal outputted from the 1st outgoing end T5 from the 2nd outgoing end T6 from the 3rd outgoing end T7, 90 degrees of phases are progressing compared with the signal outputted from the 4th outgoing end T8. Moreover, if 90-degree hybrid is passed once,

since a 3dB power loss will arise, the output signal from the 1st - the 4th outgoing end T5-T8 has a 6dB power loss as compared with the input signal to the 1st input edge T1. [0017] Thus, the signal inputted from the 1st input edge T1 is outputted with the phase contrast of 45 degrees from the 1st - the 4th outgoing end T5-T8.

[0018]

[Problem(s) to be Solved by the Invention] the dielectric substrate by which, as for the conventional Butler matrix, the strip conductor was formed as mentioned above in the vertical side -- one side -- a gland -- since it is constituted so that it may insert by the dielectric substrate in which the conductor was formed, few crevices are generated between dielectric substrates and connection between dielectric substrates is weak. Moreover, since it is constituted in this way, mounting of the terminal of equipment or other parts used for measurement of the circuit which constitutes the Butler matrix etc. is difficult. Moreover, it is also difficult to constitute on the same substrate as other circuits. Therefore, a technical problem called a low in an electrical property or the reliability of mounting occurred.

[0019] moreover, the dielectric substrate by which, as for the multilayer substrate, the strip conductor was formed in the vertical side using the multilayer substrate -- one side - - a gland -- since it manufactured by inserting, ****ing and stopping and carrying out by the dielectric substrate in which the conductor was formed, it is expensive and the technical problem that a manufacturing process was complicated occurred

[0020] It was made in order that this invention might solve the above technical problems, and an electrical property and the reliability of mounting are high, and it is cheap, and manufacture aims at acquiring the easy Butler matrix.

[0021]

[Means for Solving the Problem] The main dielectric substrate by which, as for the Butler matrix concerning this invention, the 1st strip conductor was formed in the upper surface, The small dielectric substrate for hybrid section composition which the 2nd strip conductor was formed in the inferior surface of tongue, and was mounted in the field for hybrid section composition of the upper surface of the main dielectric substrate by the flip chip method, The 3rd strip conductor is formed in an inferior surface of tongue, and the 4th strip conductor is formed in the upper surface. It has the small dielectric substrate for track intersection composition mounted in the field for track intersection composition of the upper surface of the main dielectric substrate by the flip chip method. The 1st tie way composition section of the 1st strip conductor in which the hybrid section has the length from which the phase contrast between the outgoing ends in desired frequency prepared in the field for hybrid section composition becomes 90 degrees, The tie way constituted using the 2nd tie way composition section of the 2nd strip conductor which has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, The 1st vertical connection of the 1st strip conductor which it was estranged and prepared in the field for hybrid section composition on both sides of the 1st tie way composition section, and was connected through the 2nd strip conductor and 1st bump linked to the 2nd tie way composition section, The 2nd vertical connection of the 1st strip conductor by which it was constituted using the capacitor formed between the 1st vertical connection and the 1st bump, and the track intersection was estranged and prepared in the field for hybrid section composition, the gland established in the field of the inferior surface of tongue of the small dielectric substrate

for track intersection composition located on the field where the 1st strip conductor which crosses the straight line which connects between the 2nd vertical connection, and the straight line which connects between the 2nd vertical connection and the 1st strip conductor cross -- with a conductor a gland -- it is estranged and prepared on both sides of a conductor, and is constituted using the 3rd strip conductor connected through the 2nd vertical connection and 2nd bump, and the 4th strip conductor which connected between the 3rd strip conductor estranged and prepared through the Bahia hall

[0022] The main dielectric substrate by which, as for the Butler matrix concerning this invention, the 1st strip conductor was formed in the upper surface, The small dielectric substrate for hybrid section composition which the 2nd strip conductor was formed in the inferior surface of tongue, and was mounted in the field for hybrid section composition of the upper surface of the main dielectric substrate by the flip chip method, The 3rd strip conductor is formed in an inferior surface of tongue, and the 4th strip conductor is formed in the upper surface. It has the small dielectric substrate for track intersection composition mounted in the field for track intersection composition of the upper surface of the main dielectric substrate by the flip chip method. The 1st tie way composition section of the 1st strip conductor of the meander configuration in which the hybrid section has the length from which the phase contrast between the outgoing ends in desired frequency prepared in the field for hybrid section composition becomes 90 degrees, The tie way constituted using the 2nd tie way composition section of the 2nd strip conductor of a meander configuration which has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, On both sides of the 1st tie way composition section, it is estranged and prepared in the field for hybrid section composition. Connected through the 2nd strip conductor and 1st bump linked to the 2nd tie way composition section. The 2nd vertical connection of the 1st strip conductor by which it was constituted using the 1st vertical connection of the 1st strip conductor, and the track intersection was estranged and prepared in the field for hybrid section composition, the gland established in the field of the inferior surface of tongue of the small dielectric substrate for track intersection composition located on the field where the 1st strip conductor which crosses the straight line which connects between the 2nd vertical connection, and the straight line which connects between the 2nd vertical connection and the 1st strip conductor cross -- with a conductor a gland -- it is estranged and prepared on both sides of a conductor, and is constituted using the 3rd strip conductor connected through the 2nd vertical connection and 2nd bump, and the 4th strip conductor which connected between the 3rd strip conductor estranged and prepared through the Bahia hall

[0023] The main dielectric substrate by which, as for the Butler matrix concerning this invention, the 1st strip conductor was formed in the upper surface, The small dielectric substrate for hybrid section composition which the 2nd strip conductor was formed in the inferior surface of tongue, and the 3rd strip conductor was formed in the upper surface, and was mounted in the field for hybrid section composition of the upper surface of the main dielectric substrate by the flip chip method, The 4th strip conductor is formed in an inferior surface of tongue, and the 5th strip conductor is formed in the upper surface. It has the small dielectric substrate for track intersection composition mounted in the field for track intersection composition of the upper surface of the main dielectric substrate by the flip chip method. The 1st tie way composition section of the 2nd strip conductor in

which the hybrid section has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, The tie way constituted using the 2nd tie way composition section of the 3rd strip conductor which has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, The 1st vertical connection of the 1st strip conductor which it was estranged and prepared in the field for hybrid section composition, and was connected through the 2nd strip conductor and 1st bump linked to the 1st tie way composition section, It was estranged and prepared in the field for hybrid section composition, and connected through the 3rd strip conductor linked to the 2nd tie way composition section, the 2nd strip conductor connected through the Bahia hall, and the 2nd bump. The 1st capacitor formed between the 2nd vertical connection of the 1st strip conductor, the 1st vertical connection, and the 1st bump, The 3rd vertical connection of the 1st strip conductor by which it was constituted using the 2nd capacitor formed between the 2nd vertical connection and the 2nd bump, and the track intersection was estranged and prepared in the field for hybrid section composition, the gland established in the field of the inferior surface of tongue of the small dielectric substrate for track intersection composition located on the field where the 1st strip conductor which crosses the straight line which connects between the 3rd vertical connection, and the straight line which connects between the 3rd vertical connection and the 1st strip conductor cross -- with a conductor a gland -- it is estranged and prepared on both sides of a conductor, and is constituted using the 5th strip-conductor **** which connected between the 4th strip conductor connected through the 3rd vertical connection and 3rd bump, and the 4th strip conductor estranged and prepared through the Bahia hall

[0024] The main dielectric substrate by which, as for the Butler matrix concerning this invention, the 1st strip conductor was formed in the upper surface, The small dielectric substrate for hybrid section composition which the 2nd strip conductor was formed in the inferior surface of tongue, and the 3rd strip conductor was formed in the upper surface, and was mounted in the field for hybrid section composition of the upper surface of the main dielectric substrate by the flip chip method, The 4th strip conductor is formed in an inferior surface of tongue, and the 5th strip conductor is formed in the upper surface. It has the small dielectric substrate for track intersection composition mounted in the field for track intersection composition of the upper surface of the main dielectric substrate by the flip chip method. The 1st tie way composition section of the 2nd strip conductor of the meander configuration in which the hybrid section has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, The tie way constituted using the 2nd tie way composition section of the 3rd strip conductor of a meander configuration which has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, The 1st vertical connection of the 1st strip conductor which it was estranged and prepared in the field for hybrid section composition, and was connected through the 2nd strip conductor and 1st bump linked to the 1st tie way composition section, It was estranged and prepared in the field for hybrid section composition, and connected through the 3rd strip conductor linked to the 2nd tie way composition section, the 2nd strip conductor connected through the Bahia hall, and the 2nd bump. The 3rd vertical connection of the 1st strip conductor by which it was constituted using the 2nd vertical connection of the 1st strip conductor, and the track intersection was estranged and prepared in the field for hybrid section composition, the

gland established in the field of the inferior surface of tongue of the small dielectric substrate for track intersection composition located on the field where the 1st strip conductor which crosses the straight line which connects between the 3rd vertical connection, and the straight line which connects between the 3rd vertical connection and the 1st strip conductor cross -- with a conductor a gland -- it being estranged and prepared on both sides of a conductor, and with the 4th strip conductor connected through the 3rd vertical connection and 3rd bump a gland -- it is constituted using the 5th strip conductor which connected between the 4th strip conductor estranged and prepared on both sides of the conductor through the Bahia hall

[0025] The 1st and 2nd tie way composition sections of the Butler matrix concerning this invention are linear [-like].

[0026] The 1st and 2nd tie way composition sections of the Butler matrix concerning this invention are meander configurations.

[0027] The Butler matrix concerning this invention has a dielectric constant with the larger small dielectric substrate for hybrid section composition than the dielectric constant of the main dielectric substrate.

[0028]

[Embodiments of the Invention] Hereafter, one gestalt of implementation of this invention is explained.

Gestalt 1. drawing 1 of operation is the plan of the Butler matrix by the gestalt 1 of implementation of this invention. Drawing 2 is the plan of the main dielectric substrate which constitutes the Butler matrix by the gestalt 1 of implementation of this invention. In drawing 1 the main dielectric substrate and 2a for the Butler matrix and 2 The upper surface of the main dielectric substrate 2, the 1- by which 3-6 were mounted in upper surface 2a of the main dielectric substrate 2 by the flip chip method -- the 4th small dielectric substrate (small dielectric substrate for hybrid section composition) -- The 5th small dielectric substrate by which 7 was mounted in upper surface 2a of the main dielectric substrate 2 by the flip chip method (small dielectric substrate for track intersection composition), The 1st strip conductor by which 8 was formed in upper surface 2a of the main dielectric substrate 2, 9-12 -- the 1- the 1- equipped with 4th 90-degree hybrid -- the 4th hybrid section, the 1st which 13 and 14 equipped with the 1st and 2nd 45-degree fixed phase shifter, the 2nd fixed phase-shifter section, and 15 are track intersections which a microstrip line intersects the 1- the composition of the 4th hybrid section 9-12 is the same

[0029] A1-D1 -- the 1- the 1st of the main dielectric substrate 2 which constitutes the 4th hybrid section 9-12 - the 4th field (field for hybrid section composition) -- the 1- of the 5th field (field for track intersection composition) of the main dielectric substrate 2 where E constitutes the track intersection 15, and the signal which inputs T1-T4 into the Butler matrix 1 -- the 4th input edge, and T5-T8 are the 1st of the signal outputted from the Butler matrix 1 - the 4th outgoing end the 1- the 4th small dielectric substrate 3-6 is mounted in the 1st of upper surface 2a of the main dielectric substrate 2 - the 4th field A1-D1 by the flip chip method, respectively, and the 5th small dielectric substrate 7 is mounted in the 5th field E of upper surface 2a of the main dielectric substrate 2 by the flip chip method

[0030] Drawing 3 is the enlarged view of the 1st field A1 of upper surface 2a of the main dielectric substrate 2. Drawing 4 is the enlarged view of the inferior surface of tongue of

the 1st small dielectric substrate 3. Drawing 5 is the side elevation of the 1st hybrid section 9, and shows the state where the 1st small dielectric substrate 3 was mounted in the 1st field A1 of upper surface 2a of the main dielectric substrate 2 by the flip chip method. In drawing 16 The 1st tie way composition section of the shape of linear [of the 1st strip conductor 8], The 1st capacitor by which 17 was formed in the 1st vertical connection of the 1st strip conductor 8, and 18 was formed on the 1st vertical connection 17, The 5th of the 1st bump by whom 19 was formed on the 1st capacitor 18, and the signal which inputs T9 and T10 into the 1st hybrid section 9, the 6th input edge, The 5th of the signal which outputs T11 and T12 from the 1st hybrid section 9, the 6th outgoing end, The 2nd strip conductor by which 3b was formed in the inferior surface of tongue of the 1st small dielectric substrate 3, and 20 was formed in inferior-surface-of-tongue 3b of the 1st small dielectric substrate 3, the 1st gland where the edge of the 2nd strip conductor 20 and 2b were formed in the inferior surface of tongue of the main dielectric substrate 2, and 23 was formed [21] in inferior-surface-of-tongue 2b of the main dielectric substrate 2 for the 2nd tie way composition section of the shape of linear [of the 2nd strip conductor 20], and 22 -- it is a conductor The 1st and 2nd tie way composition section 16 and 21 has one fourth of the length (namely, length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees) of the wavelength in desired frequency. The 1st vertical connection 17 is estranged and formed on both sides of the 1st tie way composition section 16, and is connected through the 2nd edge 22 and 1st bump 19 of a strip conductor 20 linked to the 2nd tie way composition section 16. The 1st capacitor 18 is formed between the 1st vertical connection 17 and the 1st bump 19. The signal inputted into the 1st and 2nd input edge T1 and T2 inputs into the 5th and 6th input edge T9 and T10.

[0031] Drawing 6 is drawing which was seen from the direction perpendicular to upper surface 2a of the main dielectric substrate 2 and in which showing the physical relationship of the component of the 1st hybrid section 9. As shown in drawing 6 , when it sees from a direction perpendicular to upper surface 2a of the main dielectric substrate 2, the 1st small dielectric substrate 3 is mounted in the 1st field A1 of upper surface 2a of the main dielectric substrate 2 so that the 1st and 2nd tie way composition section 16 and 21 may be in agreement. Thus, the tie way is constituted when the 1st and 2nd tie way composition section 16 and 21 is in agreement. Moreover, the 1st small dielectric substrate 3 is mounted in the 1st field A1 of upper surface 2a of the main dielectric substrate 2 so that the 1st bump 19 may connect with the edge 22 of the 2nd strip conductor 20.

[0032] Drawing 7 is the enlarged view of the 5th field E of upper surface 2a of the main dielectric substrate 2. Drawing 8 is the enlarged view of the inferior surface of tongue of the 5th small dielectric substrate 7. Drawing 9 is the enlarged view of the upper surface of the 5th small dielectric substrate 7. Drawing 10 is the side elevation of the track intersection 15, and shows the state where the 5th small dielectric substrate 7 was mounted in the 5th field E of upper surface 2a of the main dielectric substrate 2 by the flip chip method. The 2nd bump by whom 24 was formed in the 2nd vertical connection of the 1st strip conductor 8, and 25 was formed on the 2nd vertical connection 24 in drawing, the 2nd gland where 26 was formed in upper surface 2a of the main dielectric substrate 2 -- a conductor -- 27 -- the 2nd gland -- the 3rd bump formed on the conductor 26, and the 1st gland where 28 was formed in inferior-surface-of-tongue 2b of the main

dielectric substrate 2 -- the 2nd gland formed in a conductor 23 and upper surface 2a -- the 1st Bahia hall which connects a conductor 26 -- The input edge of the 7th octavus of the signal which inputs T13 and T14 into the track intersection 15, The outgoing end of the 7th octavus of the signal which outputs T15 and T16 from the track intersection 15, The 3rd strip conductor by which 7b was formed in the inferior surface of tongue of the 5th small dielectric substrate 7, and 29 was formed in inferior-surface-of-tongue 7b of the 5th small dielectric substrate 7, The outside edge of the 3rd strip conductor 29 and 31 30 The inside edge of the 3rd strip conductor 29, the 3rd gland where 32 was formed in inferior-surface-of-tongue 7b of the 5th small dielectric substrate 7 -- a conductor -- the 3rd gland where 33 is located between the inside edges 31 of the 3rd strip conductor 29 -- the center section of the conductor 32 -- the 3rd gland which 34 connects with a center section 33 -- the periphery of a conductor 32, and 7a -- the upper surface of the 5th small dielectric substrate 7 -- The 4th strip conductor by which 35 was formed in upper surface 7a of the 5th small dielectric substrate 7, and 36 are the 2nd Bahia hall which connects the inside edge 31 of the 3rd strip conductor 29 formed in inferior-surface-of-tongue 7b of the 5th small dielectric substrate 7, and the 4th strip conductor 35 formed in upper surface 7a. The 2nd vertical connection 24 estranges, and is prepared and the 1st strip conductor 8 which connects to the input edge T14 of the octavus and the 7th outgoing end T15 the straight line which connects between the 2nd vertical connection 24 crosses it. A center section 33 is located on the field where the straight line which connects between the 2nd vertical connection 24, and the 1st strip conductor 8 cross. The 3rd strip conductor 29 is estranged and formed across a center section 33, and is connected through the 2nd vertical connection 24 and 2nd bump 25. The 4th strip conductor 35 connects between the 3rd strip conductor 29 estranged and prepared through the 2nd Bahia hall 36.

[0033] Drawing 11 is drawing which was seen from the direction perpendicular to upper surface 2a of the main dielectric substrate 2 and in which showing the physical relationship of the component of the track intersection 15. As shown in drawing 11 , when it sees from a direction perpendicular to upper surface 2a of the main dielectric substrate 2, While the 1st strip conductor 8 linked to the 7th input edge T13 and the outgoing end T16 of the octavus, the 3rd strip conductor 29, and the 4th strip conductor 35 serve as a straight line The 5th small dielectric substrate 7 is mounted in the 5th field E of upper surface 2a of the main dielectric substrate 2 so that the 1st strip conductor 8 which the 4th strip conductor 35 connects to the input edge T14 of the octavus and the 7th outgoing end T15 may be intersected. The center section 33 of the conductor 32 is located between the 4th strip conductor 35 in a portion and the 1st strip conductor 8 which the 4th strip conductor 35 and 1st strip conductor 8 intersect. for this reason, the 3rd gland -- the 3rd gland -- the periphery 34 of a conductor 32 is located in the field across which it faces on the track which connects the track and the input edge T14 of the octavus which connect the 7th input edge T13 and the outgoing end T16 of the octavus, and the 7th outgoing end T15 thus, the 3rd gland -- combination is suppressed when the center section 33 of the conductor 32 is located in the portion which the 4th strip conductor 35 and 1st strip conductor 8 intersect moreover, the 2nd bump 25 -- the outside edge 30 of the 3rd strip conductor 29 -- connecting -- the 3rd bump 27 -- the 3rd gland -- the 5th small dielectric substrate 7 is mounted in the 5th field E of upper surface 2a of the main dielectric substrate 2 so that it may connect with the periphery 34 of a conductor 32

[0034] the 2nd gland -- a conductor 26 -- the 3rd bump 27 -- minding -- the 3rd gland -- a conductor 32 -- electric -- connecting -- the 1st Bahia hall 28 -- minding -- the 1st gland -- since it connects with a conductor 23 electrically -- the 1st gland -- a conductor 23 and the 2nd gland -- a conductor 26 and the 3rd gland -- a conductor 32 is this potential altogether

[0035] Drawing 12 is the circuit diagram of the Butler matrix by the gestalt 1 of implementation of this invention. drawing -- setting -- 37-40 -- the 1- as for 4th 90-degree hybrid, and 41 and 42, the 1st, 2nd 45-degree fixed phase shifter, and 43-45 are the 2nd - the 4th capacitor Other components are the same or equivalent to what attached and showed the same sign in drawing 1 - drawing 10. As shown in drawing 12 , the 1st capacitor 18 is connected to the I/O edge of the 1st 90-degree hybrid 37, the 2nd capacitor 43 is connected to the I/O edge of the 2nd 90-degree hybrid 38, the 3rd capacitor 44 is connected to the I/O edge of the 3rd 90-degree hybrid 39, and the 4th capacitor 45 is connected to the I/O edge of the 4th 90-degree hybrid 40.

[0036] Thus, the Butler matrix 1 of the gestalt of this operation The 4th small dielectric substrate 3-6 is mounted by the flip chip method. upper surface 2a of the main dielectric substrate 2 of monolayer structure -- the 1- of monolayer structure -- the conductor formed in the main dielectric substrate 2, and the 1- the conductor formed in the 4th small dielectric substrate 3-6 -- using -- the 1-, while constituting the 4th hybrid section 9-12 The 5th small dielectric substrate 7 of monolayer structure is mounted in upper surface 2a of the main dielectric substrate 2 of monolayer structure by the flip chip method, and structure which constitutes the track intersection 15 using the conductor formed at the main dielectric substrate 2 and the conductor formed in the 5th small dielectric substrate 7 is carried out.

[0037] Next, operation is explained. The signal inputted from the 1st input edge T1 is inputted into the 1st hybrid section 9 from the 5th input edge T9, and reaches the 2nd tie way composition section 21 through the 1st capacitor 18 and the 1st bump 19. Since the 1st small dielectric substrate 3 is mounted in the upper surface of the main dielectric substrate 2 and the tie way is constituted so that the 1st and 2nd tie way composition section 16 and 21 may be located up and down The signal which reached the 2nd tie way composition section 21 While carrying out magnetic field combination through the above-mentioned tie way and outputting out of the 1st hybrid section 9 from the 5th outgoing end T11, it outputs out of the 1st hybrid section 9 from the 6th outgoing end T12 through the 1st bump 19 and the 1st capacitor 18. 90 degrees of phases are progressing from the signal which outputs the signal outputted from the 5th outgoing end T11 from the 6th outgoing end T12.

[0038] The signal outputted from the 6th outgoing end T12 is inputted into the track intersection 15 from the 7th input edge T13, and reaches the 4th strip conductor 35 through the 2nd bump 25, the 3rd strip conductor 29, and the 2nd Bahia hall 36. the 3rd gland, since the 5th small dielectric substrate 7 is mounted in the upper surface of the main dielectric substrate 2 and combination is suppressed so that the center section 33 of the conductor 32 may be located in the portion which the 4th strip conductor 35 and 1st strip conductor 8 intersect The signal which reached the 4th strip conductor 35 is outputted out of the track intersection 15 from the outgoing end T16 of the octavus as it is through the 2nd Bahia hall 36, the 3rd strip conductor 29, and the 2nd bump 25. The signal outputted from the outgoing end T16 of the octavus is inputted into the 4th hybrid

section 12.

[0039] On the other hand, the signal outputted from the 5th outgoing end T11 passes the 1st fixed phase-shifter section 13, and inputs it into the 2nd hybrid section 10.

[0040] When passing the 1st fixed phase-shifter section 13, 45 degrees of phases are late for the case where the track intersection 15 is passed. Therefore, the signal which outputs from the 5th outgoing end T11, passes the 1st fixed phase-shifter section 13, and is inputted into the 2nd hybrid section 10. In order for 90 degrees to progress in the 1st hybrid section 9 and for 45 degrees to be overdue in the 1st fixed phase-shifter section 13 compared with the signal which outputs from the 6th outgoing end T12, passes the track intersection 15, and is inputted into the 4th hybrid section 12, it unites and 45 degrees is progressing.

[0041] The signal which the signal inputted into the 2nd hybrid section 10 was distributed to the 1st outgoing end T5 and 2nd outgoing end T6 like the case where it mentions above, and was inputted into the 4th hybrid section 12 is distributed to the 3rd outgoing end T7 and 4th outgoing end T8 like the case where it mentions above. 90 degrees of phases are progressing from the signal with which a phase outputs the signal which is progressing 90 degrees and is outputted from the 3rd outgoing end T7 from the 4th outgoing end T8 from the signal which outputs the signal outputted from the 1st outgoing end T5 from the 2nd outgoing end T6. Therefore, as for the signal which 45 degrees of phases progress and outputs the signal which 135 degrees of phases progress and outputs the signal outputted from the 1st outgoing end T5 from the 2nd outgoing end T6 from the 3rd outgoing end T7, 90 degrees of phases are progressing compared with the signal outputted from the 4th outgoing end T8. Moreover, if 90-degree hybrid is passed once, since a 3dB power loss will arise, the output signal from the 1st - the 4th outgoing end T5-T8 has a 6dB power loss as compared with the input signal to the 1st input edge T1.

[0042] Thus, the signal inputted from the 1st input edge T1 is outputted with the phase contrast of 45 degrees from the 1st - the 4th outgoing end T5-T8. the 2- the inputted signal is similarly outputted with the phase contrast of 45 degrees from the 4th input edge T2-T4 from the 1st - the 4th outgoing end T5-T8. By changing the input edge of a signal with a switch, the phase of the signal outputted from each outgoing end can be changed, and the sense of the wave front formed by the signal outputted from each outgoing end can be controlled.

[0043] as mentioned above -- according to the gestalt 1 of this operation -- upper surface 2a of the main dielectric substrate 2 of monolayer structure -- the 1- of monolayer structure -- the 5th small dielectric substrate 3-7 -- a flip chip method -- mounting -- the 1- since the 4th hybrid sections 9-12 and track intersection 15 were constituted, the connection resilience between dielectric substrates is not asked. Moreover, since upper surface 2a of the main dielectric substrate 2 is exposed, mounting of the terminal of equipment or other parts used for measurement of the circuit which constitutes the Butler matrix 1 etc. is easy. Therefore, the effect that an electrical property and the reliability of mounting are high is acquired.

[0044] moreover, a monolayer substrate -- using -- upper surface 2a of the main dielectric substrate 2 -- the 1- since it manufactures by mounting the 5th small dielectric substrate 3-7 by the flip chip method, it is cheap and the effect that a manufacturing process is simple is acquired.

[0045] Moreover, since a capacitor is formed in the I/O section of 90-degree hybrid, the

effect that prevention of the direct current at the time of combining of shortening of a tie way, wide-band-izing of a passband, and amplifier can be performed small is acquired. [0046] moreover, the circuit of a request to other fields of the main dielectric substrate 2 - it can also form -- moreover, inferior-surface-of-tongue 2b of the main dielectric substrate 2 -- a gland -- since the conductor is formed, it can also mount in a metal package like other active elements

[0047] Gestalt 2. drawing 13 of operation is the plan of the Butler matrix by the gestalt 2 of implementation of this invention. Drawing 14 is the plan of the main dielectric substrate which constitutes the Butler matrix by the gestalt 2 of implementation of this invention. the 1st strip conductor by which 51 was formed in the Butler matrix and 52 was formed in upper surface 2a of the main dielectric substrate 2 in drawing, and 53-56 -- the 1- the 1- equipped with 4th 90-degree hybrid -- it is the 4th hybrid section the 1- the composition of the 4th hybrid section 53-56 is the same

[0048] A2-D2 -- the 1- they are the 1st of the main dielectric substrate 2 which constitutes the 4th hybrid section 53-56 - the 4th field (field for hybrid section composition) the 1- the 4th small dielectric substrate 3-6 is mounted in the 1st of upper surface 2a of the main dielectric substrate 2 - the 4th field A2-D2 by the flip chip method, respectively

[0049] Drawing 15 is the enlarged view of the 1st field A2 of upper surface 2a of the main dielectric substrate 2. Drawing 16 is the enlarged view of the inferior surface of tongue of the 1st small dielectric substrate 3. In drawing 57 The 1st tie way composition section of the meander configuration of the 1st strip conductor 52, The 1st bump by whom 58 was formed in the 1st vertical connection of the 1st strip conductor 52, and 59 was formed on the 1st vertical connection 58, As for the 2nd strip conductor by which 60 was formed in inferior-surface-of-tongue 3b of the 1st small dielectric substrate 3, and 61, the 2nd tie way composition section of the meander configuration of the 2nd strip conductor 60 and 62 are the edges of the 2nd strip conductor 60. The 1st and 2nd tie way composition section 57 and 61 has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees. The 1st vertical connection 58 is estranged and formed on both sides of the 1st tie way composition section 57, and is connected through the 2nd edge 62 and 1st bump 59 of a strip conductor 60 linked to the 2nd tie way composition section 61.

[0050] Drawing 17 is drawing which was seen from the direction perpendicular to upper surface 2a of the main dielectric substrate 2 and in which showing the physical relationship of the component of the 1st hybrid section 53. As shown in drawing 17 , when it sees from a direction perpendicular to upper surface 2a of the main dielectric substrate 2, the 1st small dielectric substrate 3 is mounted in the 1st field A2 of upper surface 2a of the main dielectric substrate 2 so that the 1st and 2nd tie way composition section 57 and 61 may be in agreement. Thus, the tie way is constituted when the 1st and 2nd tie way composition section 57 and 61 is in agreement. Moreover, the 1st small dielectric substrate 3 is mounted in the 1st field A2 of upper surface 2a of the main dielectric substrate 2 so that the 1st bump 59 may connect with the edge 62 of the 2nd strip conductor 60.

[0051] In addition, in drawing 13 - drawing 17 , the same sign as the gestalt 1 of operation is attached and shown in the component the same as that of the gestalt 1 of operation, or equivalent. Operation is the same as that of the gestalt 1 of operation.

[0052] As mentioned above, according to the gestalt 2 of this operation, except for the effect acquired by having formed the capacitor, the same effect as the gestalt 1 of operation is acquired.

[0053] Moreover, according to the gestalt 2 of this operation, since a tie way is a meander configuration, the effect that 90-degree hybrid is made more to small is acquired.

[0054] In addition, the effect that prevention of the direct current at the time of combining of shortening of a tie way, wide-band-izing of a passband, and amplifier can be performed small is acquired by forming a capacitor in the I/O section of 90-degree hybrid like the gestalt 1 of operation.

[0055] Gestalt 3. drawing 18 of operation is the plan of the Butler matrix by the gestalt 3 of implementation of this invention. Drawing 19 is the plan of the main dielectric substrate which constitutes the Butler matrix by the gestalt 3 of implementation of this invention. the 1st strip conductor by which 71 was formed in the Butler matrix and 72 was formed in upper surface 2a of the main dielectric substrate 2 in drawing, and 73-76 -- the 1- the 1- equipped with 4th 90-degree hybrid -- it is the 4th hybrid section the 1- the composition of the 4th hybrid section 73-76 is the same

[0056] A3-D3 -- the 1- they are the 1st of the main dielectric substrate 2 which constitutes the 4th hybrid section 73-76 - the 4th field (field for hybrid section composition) the 1- the 4th small dielectric substrate 3-6 is mounted in the 1st of upper surface 2a of the main dielectric substrate 2 - the 4th field A3-D3 by the flip chip method, respectively

[0057] Drawing 20 is the enlarged view of the 1st field A3 of upper surface 2a of the main dielectric substrate 2. Drawing 21 is the enlarged view of the inferior surface of tongue of the 1st small dielectric substrate 3. Drawing 22 is the enlarged view of the upper surface of the 1st small dielectric substrate 3. Drawing 23 is the side elevation of the 1st hybrid section 73, and shows the state where the 1st small dielectric substrate 3 was mounted in the 1st field A3 of upper surface 2a of the main dielectric substrate 2 by the flip chip method. In drawing 77 The 1st vertical connection of the 1st strip conductor 72, The 1st capacitor by which 78 was formed in the 2nd vertical connection of the 1st strip conductor 72, and 79 was formed on the 1st vertical connection 77, The 2nd capacitor by which 80 was formed on the 2nd vertical connection 78, the 1st bump by whom 81 was formed on the 1st capacitor 79, The 2nd bump by whom 82 was formed on the 2nd capacitor 80, the 2nd strip conductor by which 83 was formed in inferior-surface-of-tongue 3b of the 1st small dielectric substrate 3, 84 The 1st tie way composition section of the shape of linear [of the 2nd strip conductor 83], The 1st edge of the 2nd strip conductor 83 and 86 85 The 3rd vertical connection of the 2nd strip conductor 83, The 3rd strip conductor by which 3a was formed in the upper surface of the 1st small dielectric substrate 3, and 87 was formed in upper surface 3a of the 1st small dielectric substrate 3, 88 The 2nd tie way composition section of the shape of linear [of the 3rd strip conductor 87], It is the Bahia hall which connects the 3rd vertical connection 86 of the 2nd strip conductor 83 by which 89 was formed in the 2nd edge of the 3rd strip conductor 87, and 90 was formed in inferior-surface-of-tongue 3b of the 1st small dielectric substrate 3, and the 2nd edge 89 of the 3rd strip conductor 87 formed in upper surface 3a. The 1st and 2nd tie way composition section 84 and 88 has one fourth of the length (namely, length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees) of the wavelength in desired frequency. The 1st

vertical connection 77 estranges, is prepared and is connected through the 2nd edge 85 and 1st bump 81 of a strip conductor 83 linked to the 1st tie way composition section 84. [1st] The 2nd vertical connection 78 estranges, is prepared and is connected through the 2nd vertical connection 86 and 2nd bump 82 of a strip conductor 83 who connected through the 3rd edge 89 and Bahia hall 90 of a strip conductor 87 linked to the 2nd tie way composition section 88. [2nd] [3rd] The 1st capacitor 79 is formed between the 1st vertical connection 77 and the 1st bump 81. The 2nd capacitor 80 is formed between the 2nd vertical connection 78 and the 2nd bump 82.

[0058] Drawing 24 is drawing which was seen from the direction perpendicular to upper surface 2a of the main dielectric substrate 2 and in which showing the physical relationship of the component of the 1st hybrid section 73. As shown in drawing 24 , when it sees from a direction perpendicular to upper surface 2a of the main dielectric substrate 2, the 2nd and the 3rd strip conductor 83 and 87 are formed in the 1st small dielectric substrate 3 so that the 1st and 2nd tie way composition section 84 and 88 may be in agreement. Thus, the tie way is constituted when the 1st and 2nd tie way composition section 84 and 88 is in agreement. Moreover, the 1st small dielectric substrate 3 is mounted in the 1st field A3 of upper surface 2a of the main dielectric substrate 2 so that the 1st bump 81 may connect with the 1st edge 85 of the 2nd strip conductor 83 and the 2nd bump 82 may connect with the 3rd vertical connection 86 of the 2nd strip conductor 83.

[0059] In addition, in drawing 18 - drawing 24 , the same sign as the gestalten 1 and 2 of operation is attached and shown in the component the same as that of the gestalten 1 and 2 of operation, or equivalent. Operation is the same as that of the gestalt 1 of operation.

[0060] As mentioned above, according to the gestalt 3 of this operation, the same effect as the gestalt 1 of operation is acquired.

[0061] Moreover, since a tie way is constituted using the strip conductor formed in the upper surface and the inferior surface of tongue of a small dielectric substrate according to the gestalt 3 of this operation, the distance between tie ways is decided by thickness of a small dielectric substrate. For this reason, the distance between tie ways becomes settled with high precision, and the effect that the signal inputted into 90-degree hybrid can be distributed with high degree of accuracy is acquired.

[0062] Gestalt 4. drawing 25 of operation is the plan of the Butler matrix by the gestalt 4 of implementation of this invention. Drawing 26 is the plan of the main dielectric substrate which constitutes the Butler matrix by the gestalt 4 of implementation of this invention. drawing -- setting -- 91 -- the Butler matrix, and 92-95 -- the 1- the 1- equipped with 4th 90-degree hybrid -- it is the 4th hybrid section the 1- the composition of the 4th hybrid section 92-95 is the same

[0063] A4-D4 -- the 1- they are the 1st of the main dielectric substrate 2 which constitutes the 4th hybrid section 92-95 - the 4th field (field for hybrid section composition) the 1- the 4th small dielectric substrate 3-6 is mounted in the 1st of upper surface 2a of the main dielectric substrate 2 - the 4th field A4-D4 by the flip chip method, respectively

[0064] Drawing 27 is the enlarged view of the 1st field A4 of upper surface 2a of the main dielectric substrate 2. Drawing 28 is the enlarged view of the inferior surface of tongue of the 1st small dielectric substrate 3. Drawing 29 is the enlarged view of the upper surface of the 1st small dielectric substrate 3. The 1st bump by whom 96 was

formed on the 1st vertical connection 77 in drawing, The 2nd bump by whom 97 was formed on the 2nd vertical connection 78, the 2nd strip conductor by which 98 was formed in inferior-surface-of-tongue 3b of the 1st small dielectric substrate 3, 99 The 1st tie way composition section of the meander configuration of the 2nd strip conductor 98, The 1st edge of the 2nd strip conductor 98 and 101 100 The 3rd vertical connection of the 2nd strip conductor 98, The 3rd strip conductor by which 102 was formed in upper surface 3a of the 1st small dielectric substrate 3, 103 The 2nd tie way composition section of the meander configuration of the 3rd strip conductor 102, It is the Bahia hall which connects the 3rd vertical connection 101 of the 2nd strip conductor 98 by which 104 was formed in the 2nd edge of the 3rd strip conductor 102, and 105 was formed in inferior-surface-of-tongue 3b of the 1st small dielectric substrate 3, and the edge 104 of the 3rd strip conductor 102 formed in upper surface 3a. The 1st and 2nd tie way composition section 99,103 has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees. The 1st vertical connection 77 estranges, is prepared and is connected through the 2nd edge 100 and 1st bump 96 of a strip conductor 98 linked to the 1st tie way composition section 99. [1st] The 2nd vertical connection 78 estranges, is prepared and is connected through the 2nd vertical connection 101 and 2nd bump 97 of a strip conductor 98 who connected through the 3rd edge 104 and Bahia hall 105 of a strip conductor 102 linked to the 2nd tie way composition section 103. [2nd] [3rd]

[0065] Drawing 30 is drawing which was seen from the direction perpendicular to upper surface 2a of the main dielectric substrate 2 and in which showing the physical relationship of the component of the 1st hybrid section 92. As shown in drawing 30 , when it sees from a direction perpendicular to upper surface 2a of the main dielectric substrate 2, the 2nd and the 3rd strip conductor 98,102 are formed in the 1st small dielectric substrate 3 so that the 1st and 2nd tie way composition section 99,103 may be in agreement. Thus, the tie way is constituted when the 1st and 2nd tie way composition section 99,103 is in agreement. Moreover, the 1st small dielectric substrate 3 is mounted in the 1st field A4 of upper surface 2a of the main dielectric substrate 2 so that the 1st bump 96 may connect with the 1st edge 100 of the 2nd strip conductor 98 and the 2nd bump 97 may connect with the 3rd vertical connection 101 of the 2nd strip conductor 98.

[0066] In addition, in drawing 25 - drawing 30 , the same sign as the gestalten 1-3 of operation is attached and shown in the component the same as that of the gestalten 1-3 of operation, or equivalent. Operation is the same as that of the gestalt 1 of operation.

[0067] As mentioned above, according to the gestalt 4 of this operation, except for the effect acquired by having formed the capacitor, the same effect as the gestalt 1 of operation is acquired.

[0068] Moreover, according to the gestalt 4 of this operation, since a tie way is a meander configuration, the effect that 90-degree hybrid is made more to small is acquired.

[0069] Moreover, since the tie way of a meander configuration is constituted using the strip conductor formed in the upper surface and the inferior surface of tongue of a small dielectric substrate according to the gestalt 4 of this operation, the distance between tie ways is decided by thickness of a small dielectric substrate. For this reason, the distance between tie ways becomes settled with high precision, and the effect that the signal inputted into 90-degree hybrid can be distributed with high degree of accuracy is acquired.

[0070] In addition, the effect that prevention of the direct current at the time of combining of shortening of a tie way, wide-band-izing of a passband, and amplifier can be performed small is acquired by forming a capacitor in the I/O section of 90-degree hybrid like the gestalt 3 of operation.

[0071] the gestalt 5 of gestalt 5. implementation of operation -- the 1- the 4th small dielectric substrate 3-6 is the same as that of the gestalt 3 of operation except for the point of having a larger dielectric constant than the dielectric constant of the main dielectric substrate 2

[0072] thus, the 1- when the dielectric constant of the 4th small dielectric substrate 3-6 is larger than the dielectric constant of the main dielectric substrate 2, a shortening coefficient of wavelength becomes large and the effect that 90-degree hybrid is made more to small is acquired

[0073] the gestalt 6 of gestalt 6. implementation of operation -- the 1- the 4th small dielectric substrate 3-6 is the same as that of the gestalt 4 of operation except for the point of having a larger dielectric constant than the dielectric constant of the main dielectric substrate 2

[0074] thus, the 1- when the dielectric constant of the 4th small dielectric substrate 3-6 is larger than the dielectric constant of the main dielectric substrate 2, a shortening coefficient of wavelength becomes large and the effect that 90-degree hybrid is made more to small is acquired

[0075]

[Effect of the Invention] As mentioned above, the main dielectric substrate by which the 1st strip conductor was formed in the upper surface according to this invention, The small dielectric substrate for hybrid section composition which the 2nd strip conductor was formed in the inferior surface of tongue, and was mounted in the field for hybrid section composition of the upper surface of the main dielectric substrate by the flip chip method, The 3rd strip conductor is formed in an inferior surface of tongue, and the 4th strip conductor is formed in the upper surface. It has the small dielectric substrate for track intersection composition mounted in the field for track intersection composition of the upper surface of the main dielectric substrate by the flip chip method. The 1st tie way composition section of the 1st strip conductor in which the hybrid section has the length from which the phase contrast between the outgoing ends in desired frequency prepared in the field for hybrid section composition becomes 90 degrees, The tie way constituted using the 2nd tie way composition section of the 2nd strip conductor which has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, The 1st vertical connection of the 1st strip conductor which it was estranged and prepared in the field for hybrid section composition on both sides of the 1st tie way composition section, and was connected through the 2nd strip conductor and 1st bump linked to the 2nd tie way composition section, The 2nd vertical connection of the 1st strip conductor which has the capacitor formed between the 1st vertical connection and the 1st bump and by which the track intersection was estranged and prepared in the field for hybrid section composition, the gland established in the field of the inferior surface of tongue of the small dielectric substrate for track intersection composition located on the field where the 1st strip conductor which crosses the straight line which connects between the 2nd vertical connection, and the straight line which connects between the 2nd vertical connection and the 1st strip conductor cross -- with a conductor a gland -- it

being estranged and prepared on both sides of a conductor, and with the 3rd strip conductor connected through the 2nd vertical connection and 2nd bump Since the Butler matrix was constituted so that it might have the 4th strip conductor which connected between the 3rd strip conductor estranged and prepared through the Bahia hall An electrical property and the reliability of mounting are high, and it is cheap, a manufacturing process is simple, and it is effective in the Butler matrix which can perform prevention of the direct current at the time of combining of shortening of a tie way, wide-band-izing of a passband, and amplifier small being acquired further.

[0076] The main dielectric substrate by which the 1st strip conductor was formed in the upper surface according to this invention, The small dielectric substrate for hybrid section composition which the 2nd strip conductor was formed in the inferior surface of tongue, and was mounted in the field for hybrid section composition of the upper surface of the main dielectric substrate by the flip chip method, The 3rd strip conductor is formed in an inferior surface of tongue, and the 4th strip conductor is formed in the upper surface. It has the small dielectric substrate for track intersection composition mounted in the field for track intersection composition of the upper surface of the main dielectric substrate by the flip chip method. The 1st tie way composition section of the 1st strip conductor of the meander configuration in which the hybrid section has the length from which the phase contrast between the outgoing ends in desired frequency prepared in the field for hybrid section composition becomes 90 degrees, The tie way constituted using the 2nd tie way composition section of the 2nd strip conductor of a meander configuration which has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, On both sides of the 1st tie way composition section, it is estranged and prepared in the field for hybrid section composition. Connected through the 2nd strip conductor and 1st bump linked to the 2nd tie way composition section. The 2nd vertical connection of the 1st strip conductor which has the 1st vertical connection of the 1st strip conductor and by which the track intersection was estranged and prepared in the field for hybrid section composition, the gland established in the field of the inferior surface of tongue of the small dielectric substrate for track intersection composition located on the field where the 1st strip conductor which crosses the straight line which connects between the 2nd vertical connection, and the straight line which connects between the 2nd vertical connection and the 1st strip conductor cross -- with a conductor a gland -- it being estranged and prepared on both sides of a conductor, and with the 3rd strip conductor connected through the 2nd vertical connection and 2nd bump Since the Butler matrix was constituted so that it might have the 4th strip conductor which connected between the 3rd strip conductor estranged and prepared through the Bahia hall An electrical property and the reliability of mounting are high, and it is cheap, and is effective in the Butler matrix with a simple manufacturing process being acquired.

[0077] The main dielectric substrate by which the 1st strip conductor was formed in the upper surface according to this invention, The small dielectric substrate for hybrid section composition which the 2nd strip conductor was formed in the inferior surface of tongue, and the 3rd strip conductor was formed in the upper surface, and was mounted in the field for hybrid section composition of the upper surface of the main dielectric substrate by the flip chip method, The 4th strip conductor is formed in an inferior surface of tongue, and the 5th strip conductor is formed in the upper surface. It has the small dielectric substrate for track intersection composition mounted in the field for track intersection composition

of the upper surface of the main dielectric substrate by the flip chip method. The 1st tie way composition section of the 2nd strip conductor in which the hybrid section has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, The tie way constituted using the 2nd tie way composition section of the 3rd strip conductor which has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, The 1st vertical connection of the 1st strip conductor which it was estranged and prepared in the field for hybrid section composition, and was connected through the 2nd strip conductor and 1st bump linked to the 1st tie way composition section, It was estranged and prepared in the field for hybrid section composition, and connected through the 3rd strip conductor linked to the 2nd tie way composition section, the 2nd strip conductor connected through the Bahia hall, and the 2nd bump. The 1st capacitor formed between the 2nd vertical connection of the 1st strip conductor, the 1st vertical connection, and the 1st bump, The 3rd vertical connection of the 1st strip conductor which has the 2nd capacitor formed between the 2nd vertical connection and the 2nd bump and by which the track intersection was estranged and prepared in the field for hybrid section composition, the gland established in the field of the inferior surface of tongue of the small dielectric substrate for track intersection composition located on the field where the 1st strip conductor which crosses the straight line which connects between the 3rd vertical connection, and the straight line which connects between the 3rd vertical connection and the 1st strip conductor cross -- with a conductor a gland -- it being estranged and prepared on both sides of a conductor, and with the 4th strip conductor connected through the 3rd vertical connection and 3rd bump Since the Butler matrix was constituted so that it might have the 5th strip conductor which connected between the 4th strip conductor estranged and prepared through the Bahia hall An electrical property and the reliability of mounting are high, and it is cheap, a manufacturing process is simple, and it is effective in the Butler matrix which can perform prevention of the direct current at the time of combining of shortening of a tie way, wide-band-izing of a passband, and amplifier small being acquired further.

[0078] The main dielectric substrate by which the 1st strip conductor was formed in the upper surface according to this invention, The small dielectric substrate for hybrid section composition which the 2nd strip conductor was formed in the inferior surface of tongue, and the 3rd strip conductor was formed in the upper surface, and was mounted in the field for hybrid section composition of the upper surface of the main dielectric substrate by the flip chip method, The 4th strip conductor is formed in an inferior surface of tongue, and the 5th strip conductor is formed in the upper surface. It has the small dielectric substrate for track intersection composition mounted in the field for track intersection composition of the upper surface of the main dielectric substrate by the flip chip method. The 1st tie way composition section of the 2nd strip conductor of the meander configuration in which the hybrid section has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, The tie way constituted using the 2nd tie way composition section of the 3rd strip conductor of a meander configuration which has the length from which the phase contrast between the outgoing ends in desired frequency becomes 90 degrees, The 1st vertical connection of the 1st strip conductor which it was estranged and prepared in the field for hybrid section composition, and was connected through the 2nd strip conductor and 1st bump linked to the 1st tie way composition section, It was estranged and prepared in the field for hybrid section

composition, and connected through the 3rd strip conductor linked to the 2nd tie way composition section, the 2nd strip conductor connected through the Bahia hall, and the 2nd bump. The 3rd vertical connection of the 1st strip conductor which has the 2nd vertical connection of the 1st strip conductor and by which the track intersection was estranged and prepared in the field for hybrid section composition, the gland established in the field of the inferior surface of tongue of the small dielectric substrate for track intersection composition located on the field where the 1st strip conductor which crosses the straight line which connects between the 3rd vertical connection, and the straight line which connects between the 3rd vertical connection and the 1st strip conductor cross -- with a conductor a gland -- it being estranged and prepared on both sides of a conductor, and with the 4th strip conductor connected through the 3rd vertical connection and 3rd bump Since the Butler matrix was constituted so that it might have the 5th strip conductor which connected between the 4th strip conductor estranged and prepared through the Bahia hall An electrical property and the reliability of mounting are high, and it is cheap, and is effective in the Butler matrix with a simple manufacturing process being acquired.

[0079] Since according to this invention the 1st and 2nd tie way composition sections constituted the Butler matrix so that it might be linear [-like], it is effective in the Butler matrix with the easy design of a tie way being acquired.

[0080] Since according to this invention the 1st and 2nd tie way composition sections constituted the Butler matrix so that it might be a meander configuration, it is effective in the Butler matrix as for which 90-degree hybrid is made more to small being acquired.

[0081] Since according to this invention the small dielectric substrate for hybrid section composition constituted the Butler matrix so that it might have a larger dielectric constant than the dielectric constant of the main dielectric substrate, it is effective in the Butler matrix as for which 90-degree hybrid is made more to small being acquired.

[Translation done.]

*** NOTICES ***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the plan of the Butler matrix by the gestalt 1 of implementation of this invention.

[Drawing 2] It is the plan of the main dielectric substrate which constitutes the Butler matrix by the gestalt 1 of implementation of this invention.

[Drawing 3] It is the enlarged view of the 1st field of the upper surface of the main dielectric substrate.

[Drawing 4] It is the enlarged view of the inferior surface of tongue of the 1st small dielectric substrate.

[Drawing 5] It is the side elevation of the 1st hybrid section.

[Drawing 6] It is drawing which was seen from the direction perpendicular to the upper surface of the main dielectric substrate and in which showing the physical relationship of the component of the 1st hybrid section.

[Drawing 7] It is the enlarged view of the 5th field of the upper surface of the main dielectric substrate.

[Drawing 8] It is the enlarged view of the inferior surface of tongue of the 5th small dielectric substrate.

[Drawing 9] It is the enlarged view of the upper surface of the 5th small dielectric substrate.

[Drawing 10] It is the side elevation of a track intersection.

[Drawing 11] It is drawing which was seen from the direction perpendicular to the upper surface of the main dielectric substrate and in which showing the physical relationship of the component of a track intersection.

[Drawing 12] It is the circuit diagram of the Butler matrix by the gestalt 1 of implementation of this invention.

[Drawing 13] It is the plan of the Butler matrix by the gestalt 2 of implementation of this invention.

[Drawing 14] It is the plan of the main dielectric substrate which constitutes the Butler matrix by the gestalt 2 of implementation of this invention.

[Drawing 15] It is the enlarged view of the 1st field of the upper surface of the main dielectric substrate.

[Drawing 16] It is the enlarged view of the inferior surface of tongue of the 1st small dielectric substrate.

[Drawing 17] It is drawing which was seen from the direction perpendicular to the upper surface of the main dielectric substrate and in which showing the physical relationship of the component of the 1st hybrid section.

[Drawing 18] It is the plan of the Butler matrix by the gestalt 3 of implementation of this invention.

[Drawing 19] It is the plan of the main dielectric substrate which constitutes the Butler matrix by the gestalt 3 of implementation of this invention.

[Drawing 20] It is the enlarged view of the 1st field of the upper surface of the main dielectric substrate.

[Drawing 21] It is the enlarged view of the inferior surface of tongue of the 1st small dielectric substrate.

[Drawing 22] It is the enlarged view of the upper surface of the 1st small dielectric substrate.

[Drawing 23] It is the side elevation of the 1st hybrid section.

[Drawing 24] It is drawing which was seen from the direction perpendicular to the upper surface of the main dielectric substrate and in which showing the physical relationship of the component of the 1st hybrid section.

[Drawing 25] It is the plan of the Butler matrix by the gestalt 4 of implementation of this invention.

[Drawing 26] It is the plan of the main dielectric substrate which constitutes the Butler matrix by the gestalt 4 of implementation of this invention.

[Drawing 27] It is the enlarged view of the 1st field of the upper surface of the main dielectric substrate.

[Drawing 28] It is the enlarged view of the inferior surface of tongue of the 1st small dielectric substrate.

[Drawing 29] It is the enlarged view of the upper surface of the 1st small dielectric substrate.

[Drawing 30] It is drawing which was seen from the direction perpendicular to the upper surface of the main dielectric substrate and in which showing the physical relationship of the component of the 1st hybrid section.

[Drawing 31] It is the plan of the main dielectric substrate which constitutes the conventional Butler matrix.

[Drawing 32] It is the cross section of the conventional Butler matrix in the position which met the A-A line of drawing 31 .

[Drawing 33] It is the enlarged view of the 1st field of the upper surface of the main dielectric substrate.

[Drawing 34] It is the enlarged view of the 1st field of the inferior surface of tongue of the main dielectric substrate.

[Drawing 35] It is drawing which was seen from the direction perpendicular to the upper surface of the main dielectric substrate and in which showing the physical relationship of the component of the 1st field of the main dielectric substrate.

[Drawing 36] It is the enlarged view of the 5th field of the upper surface of the main dielectric substrate.

[Drawing 37] It is the enlarged view of the 5th field of the inferior surface of tongue of the main dielectric substrate.

[Drawing 38] It is drawing which was seen from the direction perpendicular to the upper surface of the main dielectric substrate and in which showing the physical relationship of the component of the 5th field of the main dielectric substrate.

[Description of Notations]

1 Butler Matrix, 2 Main Dielectric Substrate, 2a Upper Surface, 2B Inferior Surface of Tongue, 3-6 the 1- the 4th small dielectric substrate (small dielectric substrate for hybrid section composition) -- 3a upper surface, 3b An inferior surface of tongue, 7 The 5th small dielectric substrate (small dielectric substrate for track intersection composition), 7a The upper surface and 7b An inferior surface of tongue and 8 The 1st strip conductor, and 9-12 the 1- the 4th hybrid section -- 13 14 The 1st, the 2nd fixed phase-shifter section, 15 A track intersection, 16 The 1st tie way composition section, 17 The 1st vertical connection, 18 The 1st capacitor, 19 The 1st bump, 20 The 2nd strip conductor, 21 The 2nd tie way composition section, 22 Edge, 23 the 1st gland -- a conductor and 24 The 2nd vertical connection and 25 the 2nd bump -- 26 the 2nd gland -- a conductor and 27 the 3rd bump and 28 -- the 1st Bahia hall -- 29 The 3rd strip conductor, 30 An outside edge, 31 Inside edge, 32 the 3rd gland -- a conductor and 33 A center section and 34 A periphery and 35 the 4th strip conductor -- 36 The 2nd Bahia hall, and 37-40 the 1- 4th 90-degree hybrid -- 41 42 The 1st, 2nd 45-degree fixed phase shifter, 43-45 The 2nd - the 4th capacitor, 51 The Butler matrix and 52 The 1st strip conductor, and 53-56 the 1- the 4th hybrid section -- 57 The 1st tie way composition section, 58 The 1st vertical connection, 59 The 1st bump, 60 The 2nd strip conductor, 61 The 2nd tie way composition section, 62 Edge, 71 The Butler matrix, the 72 1st strip conductor, and 73-76 the 1- the 4th hybrid section -- 77 The 1st vertical connection, 78 The 2nd vertical connection, 79 The 1st capacitor, 80 The 2nd capacitor, 81 The 1st bump, 82 The 2nd bump, 83 The 2nd strip conductor, 84 The 1st tie way composition section, 85 The 1st edge, 86 The 3rd vertical connection, 87 The 3rd strip conductor, 88 The 2nd tie way composition section, 89 The 2nd edge, 90 The Bahia hall, 91 Butler matrix, 92-95 the 1- the 4th hybrid section and 96 the 1st bump -- 97 The 2nd bump, 98 The 2nd strip conductor, 99 The 1st tie way composition section, 100 The 1st edge, 101 The 3rd vertical connection, 102 The 3rd strip conductor, 103 The 2nd tie way composition section, 104 The 2nd edge, 105 Bahia hall. A1-D1 The 1st - the 4th field (field for hybrid section composition), A2-D2 The 1st - the 4th field (field for hybrid section composition), A3-D3 The 1st - the 4th field (field for hybrid section composition), A4-D4 The 1st - the 4th field (field for hybrid section composition), the E 5th field (field for track intersection composition), and T1-T4 the 1- the 4th input edge -- T5-T8 The 1st - the 4th outgoing end, T9, T10 The 5th, the 6th input edge, T11, T12 The 5th, the 6th outgoing end, T13, T14 The input edge of the 7th octavus, T15, T16 Outgoing end of the 7th octavus.

[Translation done.]

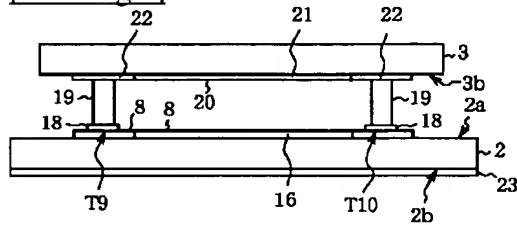
*** NOTICES ***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

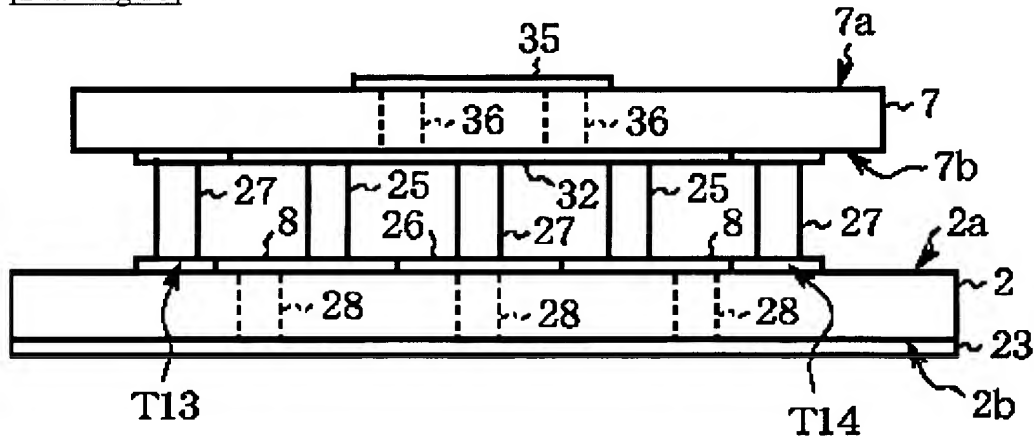
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

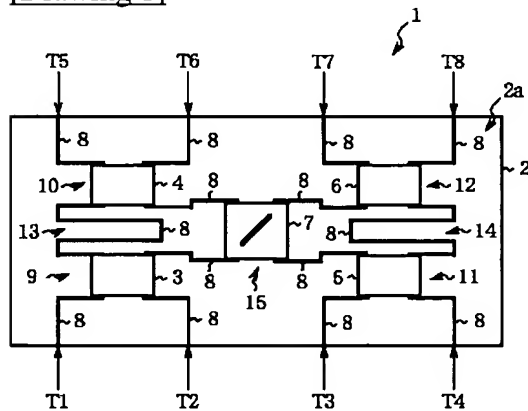
[Drawing 5]



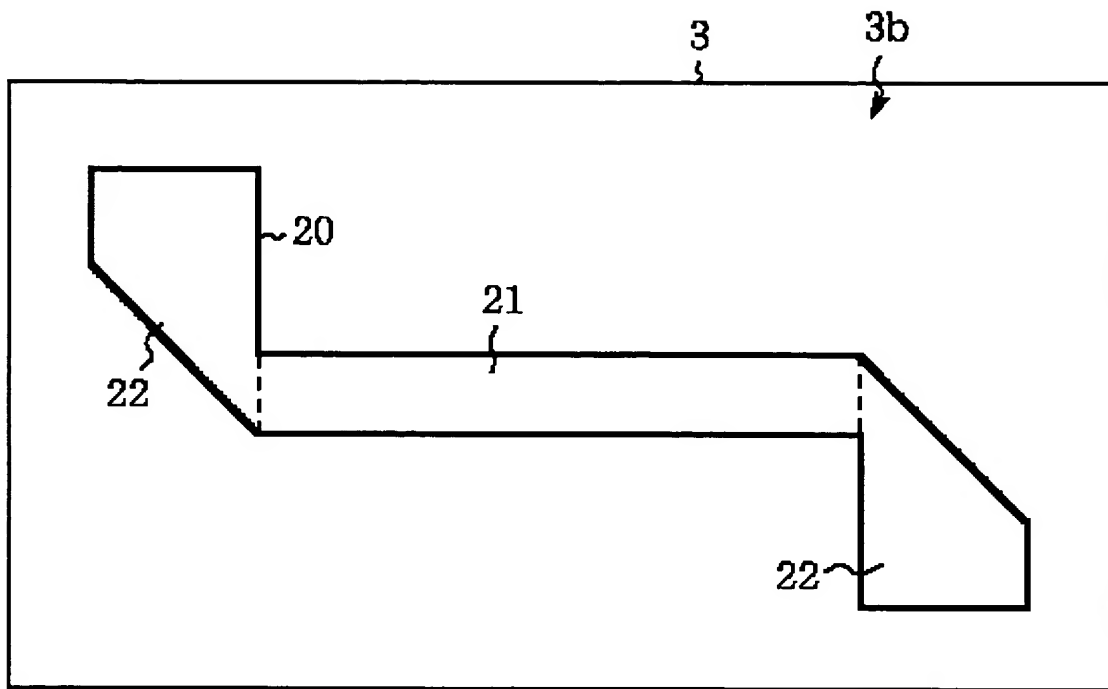
[Drawing 10]



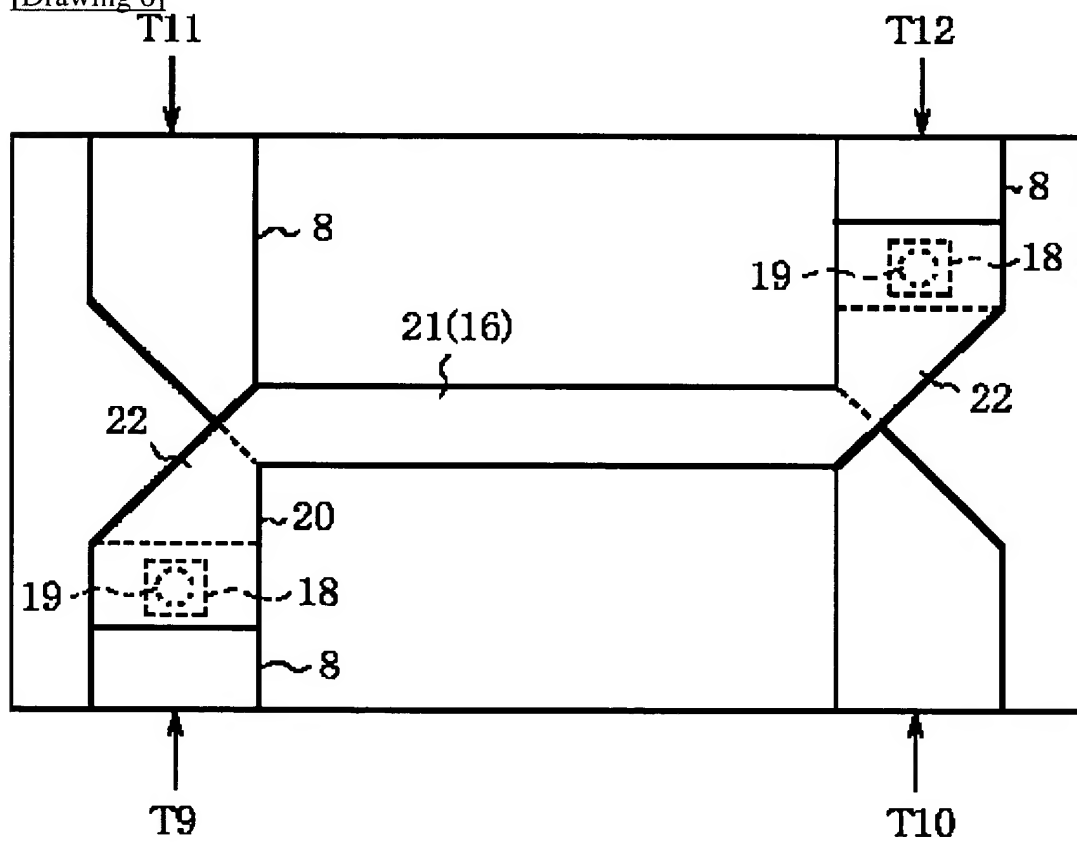
[Drawing 1]



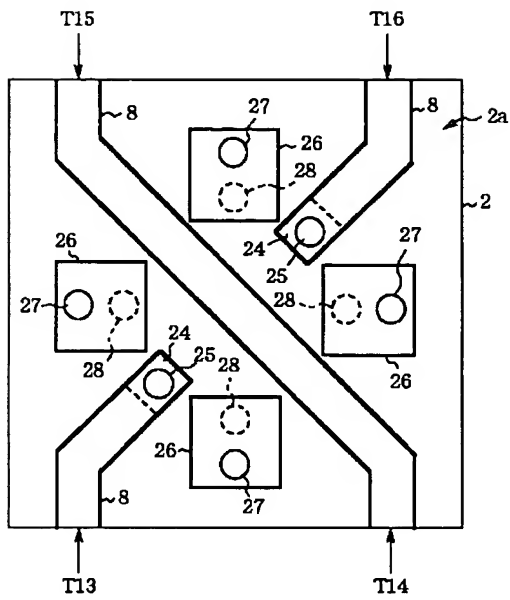
[Drawing 2]



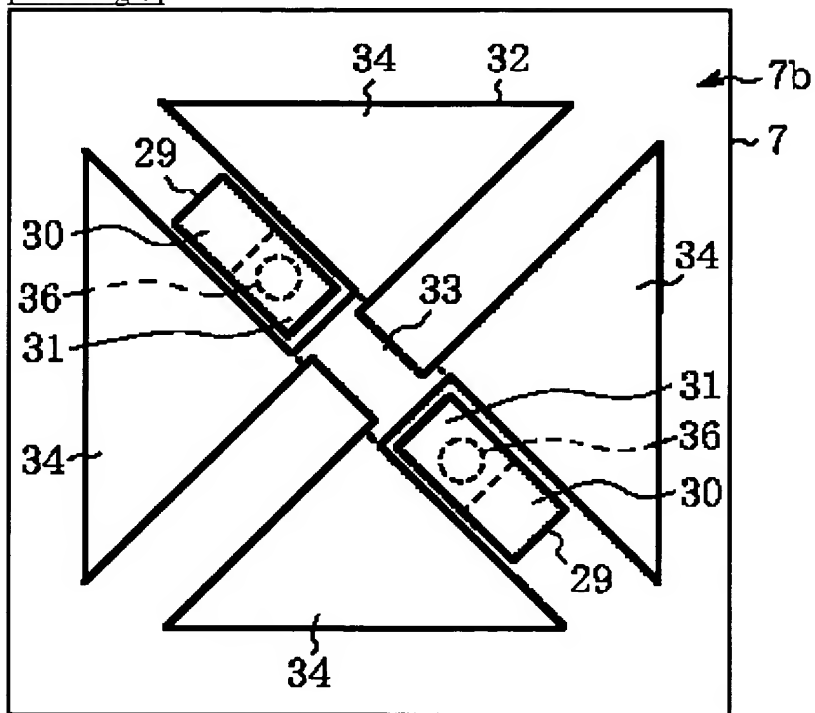
[Drawing 6]



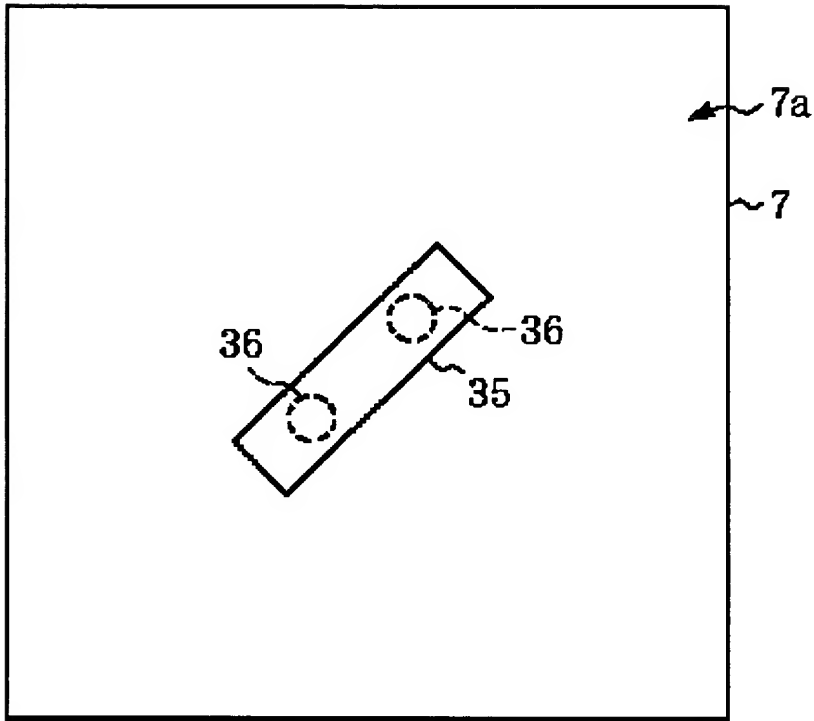
[Drawing 7]



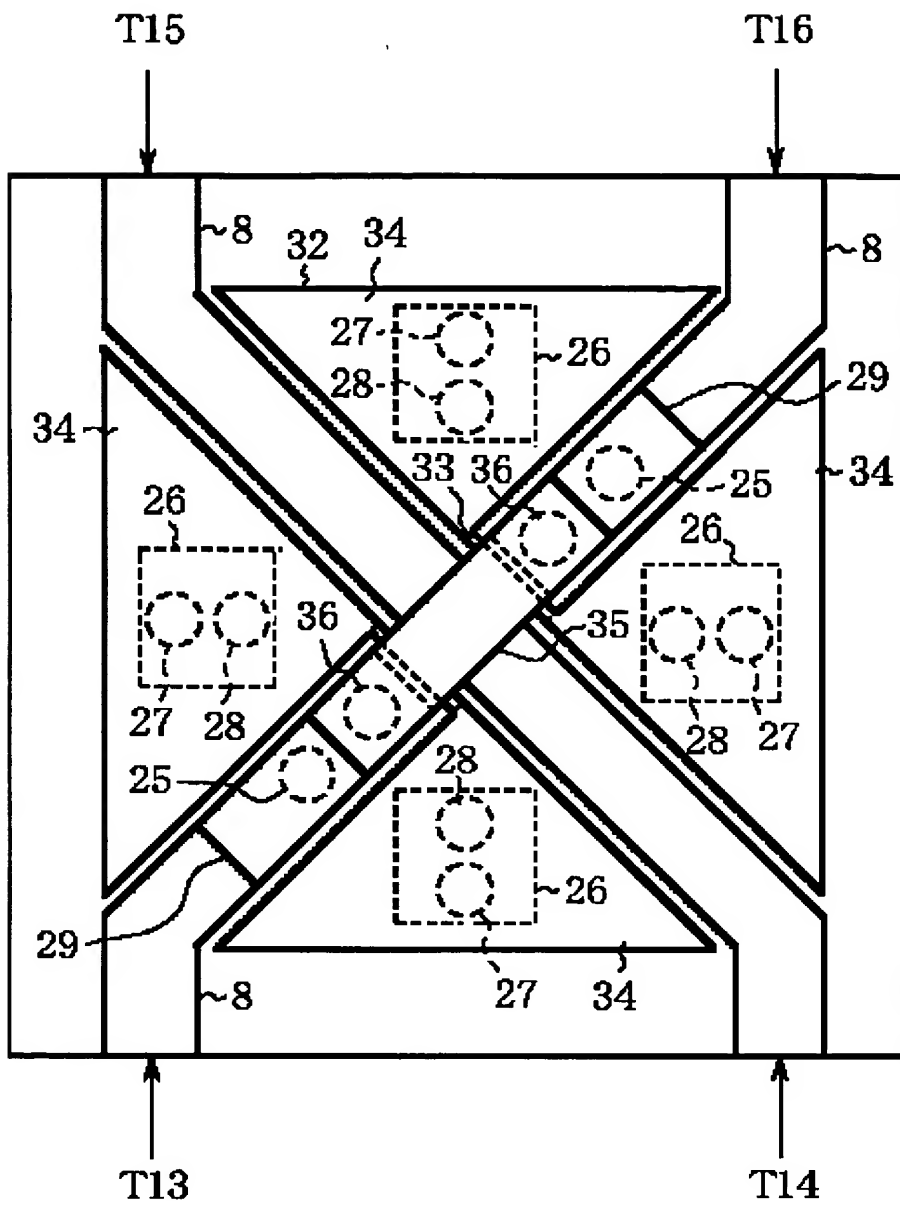
[Drawing 8]



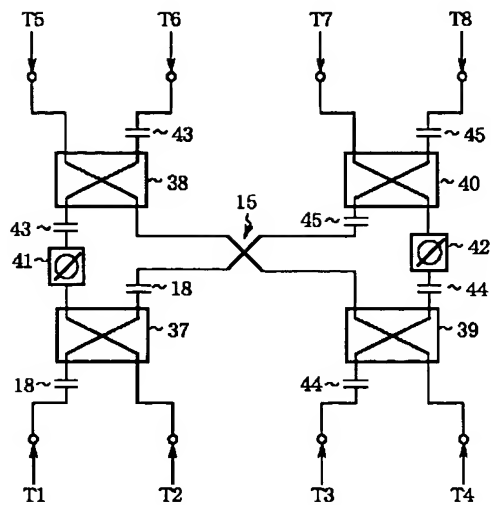
[Drawing 9]



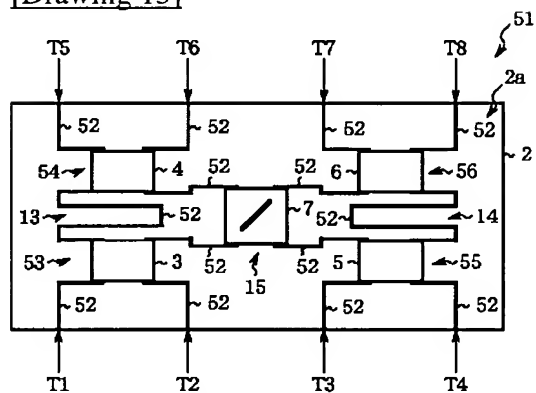
[Drawing 11]



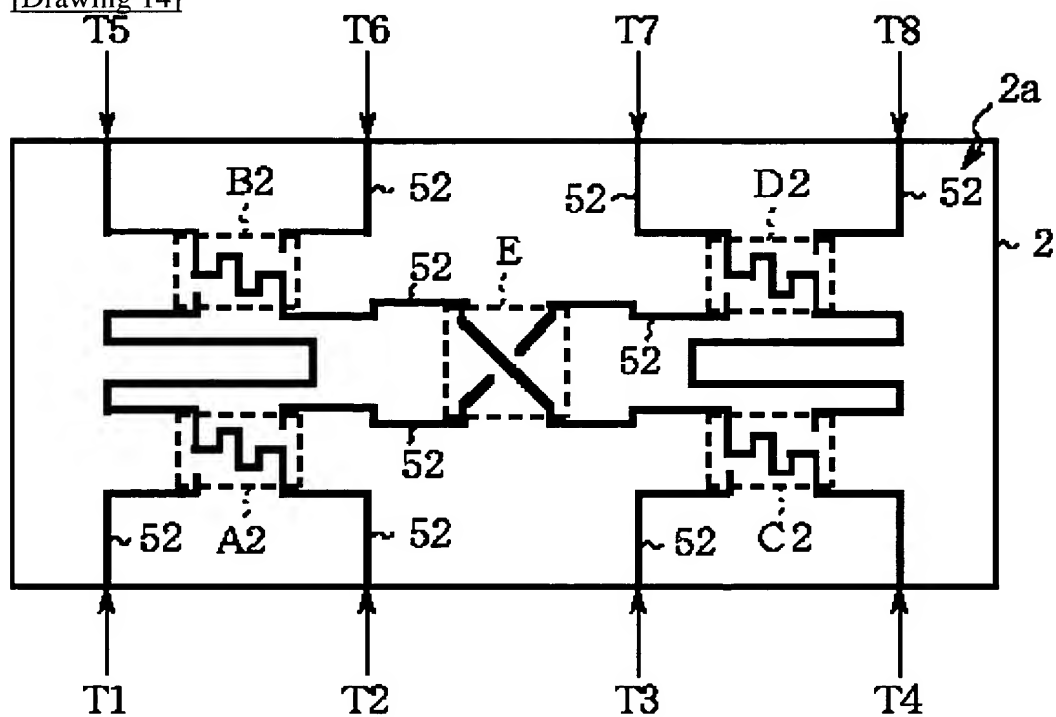
[Drawing 12]



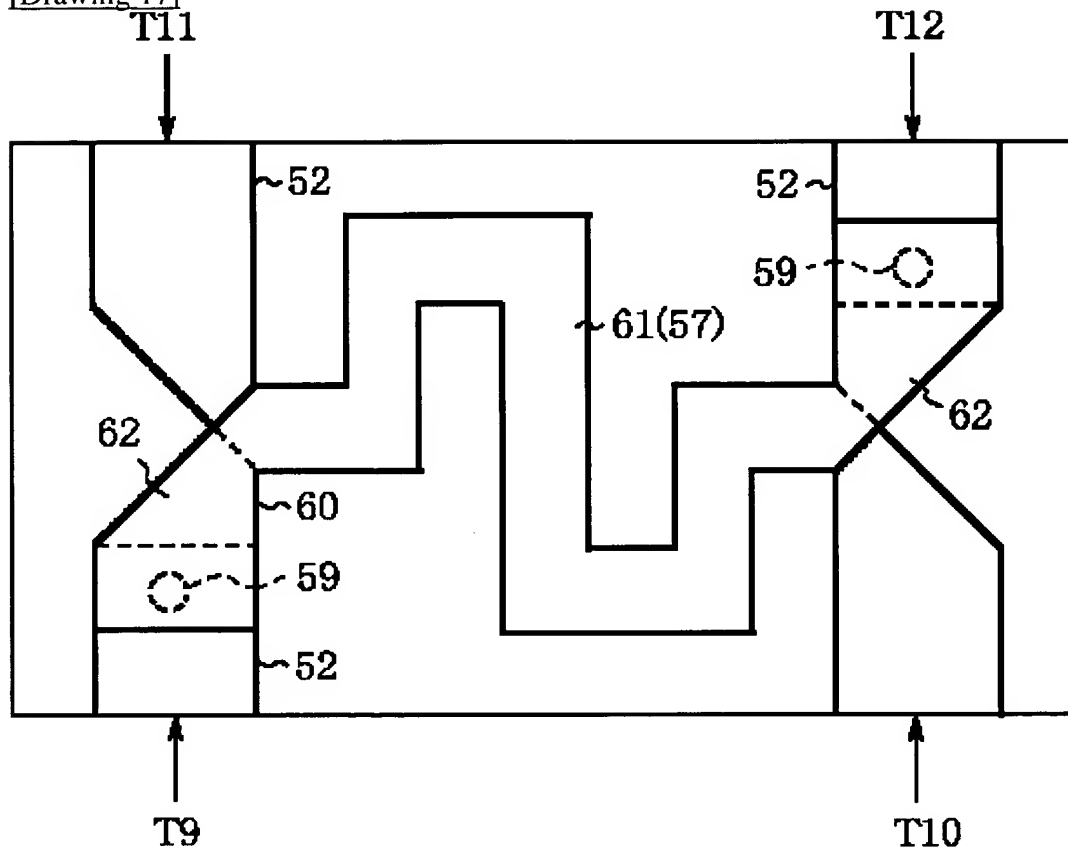
[Drawing 13]



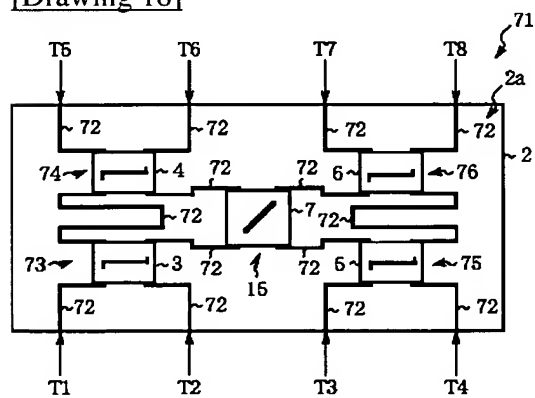
[Drawing 14]



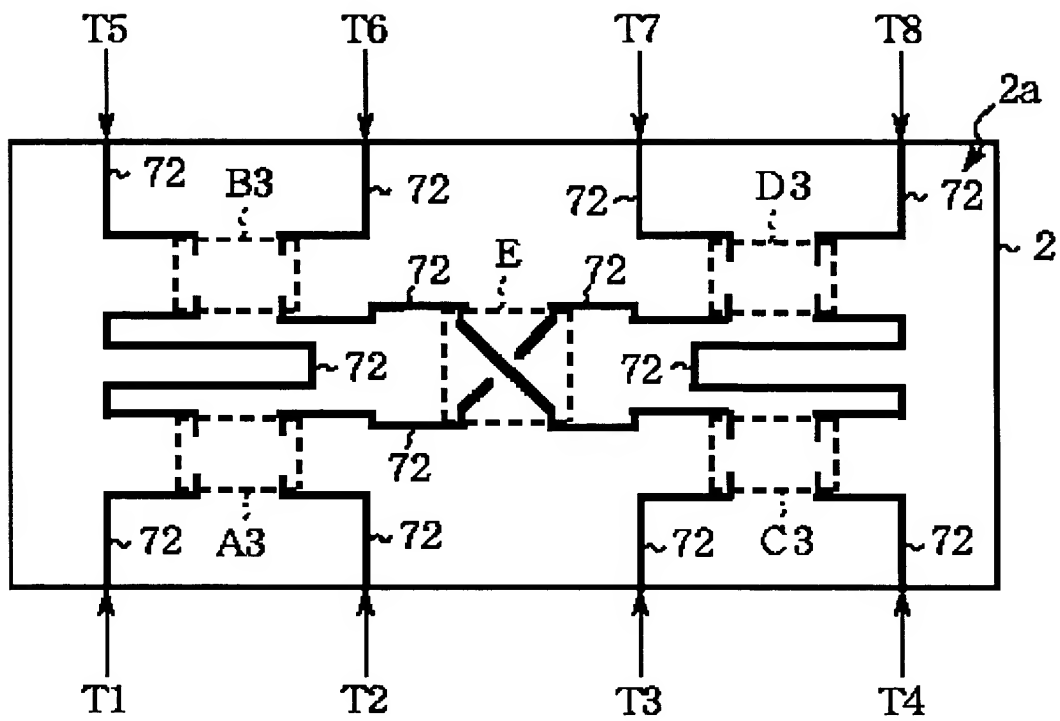
[Drawing 17]



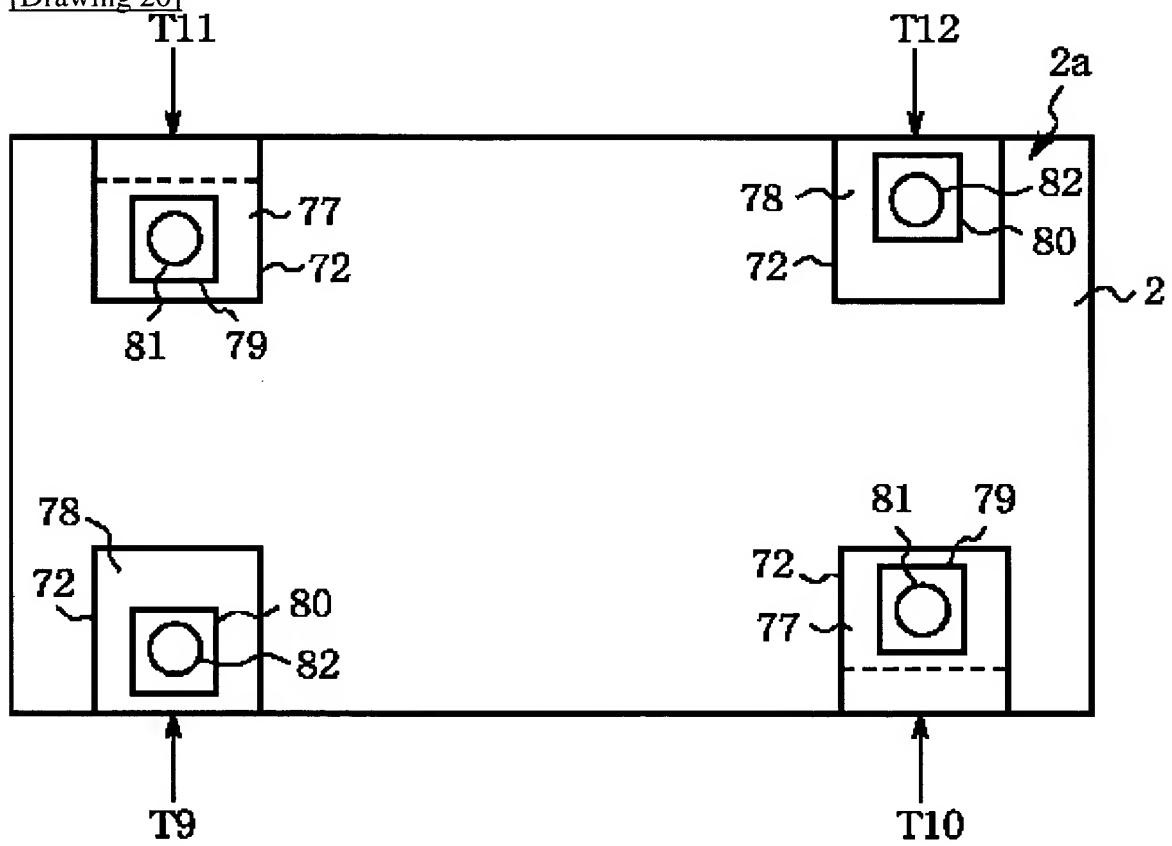
[Drawing 18]



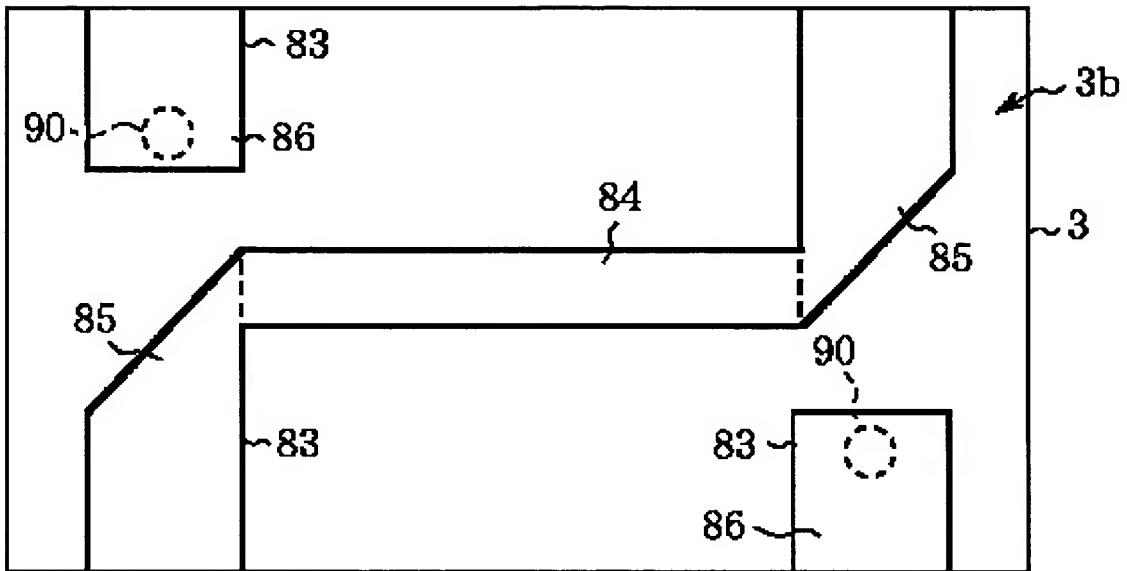
[Drawing 19]



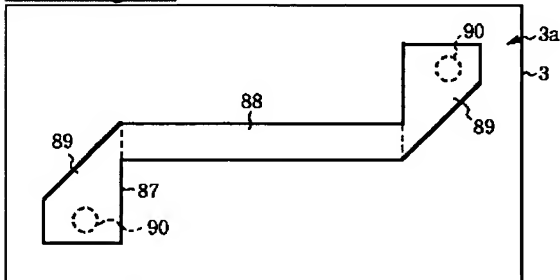
[Drawing 20]



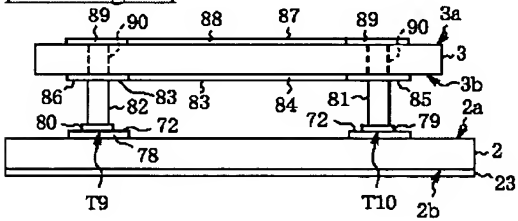
[Drawing 21]



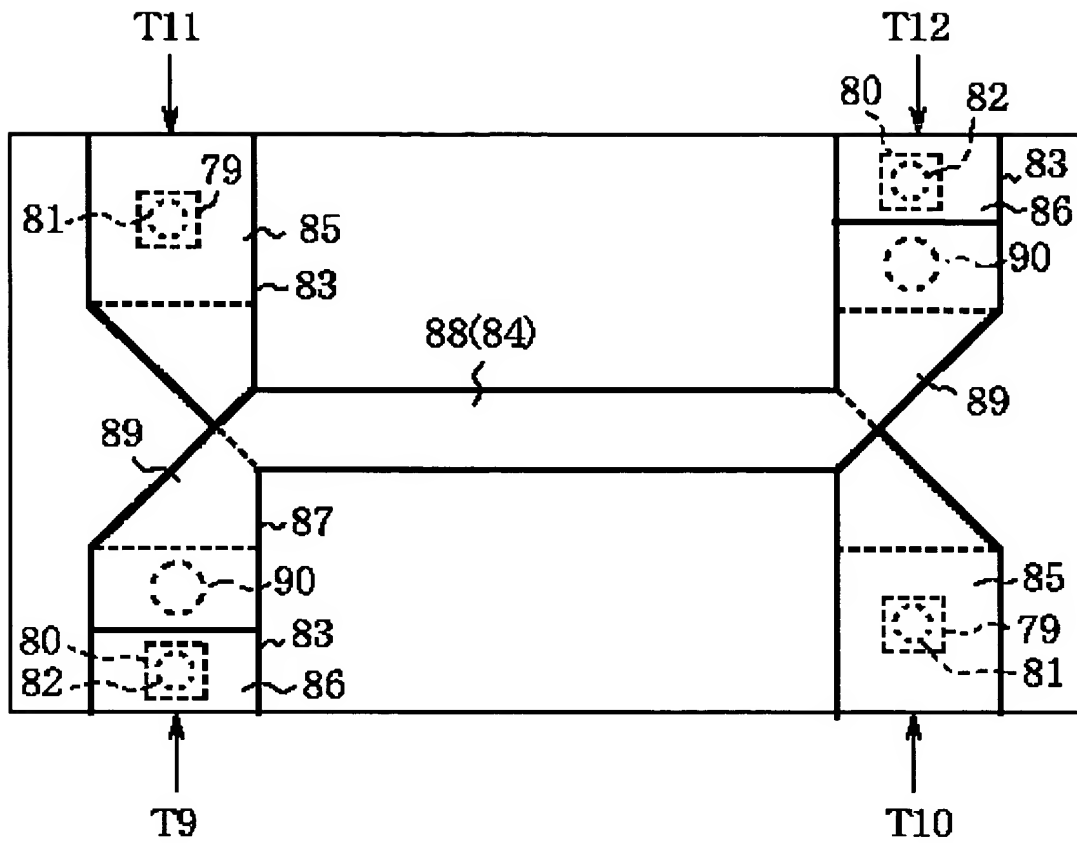
[Drawing 22]



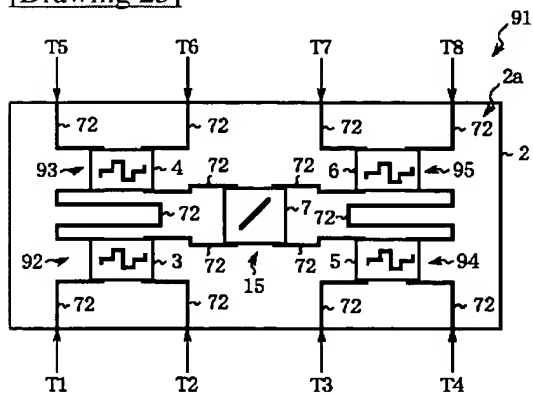
[Drawing 23]



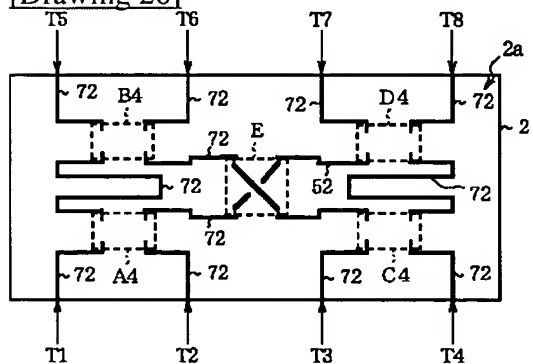
[Drawing 24]



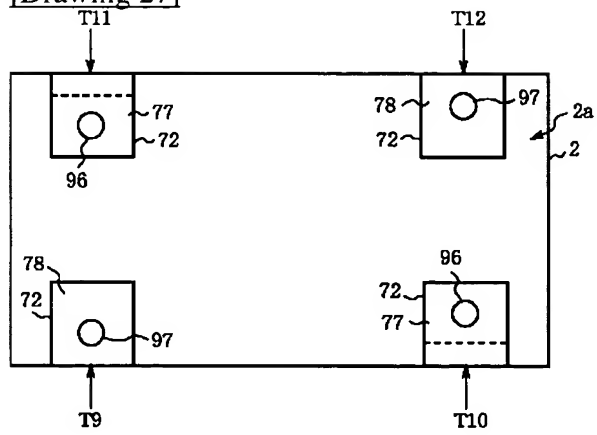
[Drawing 25]



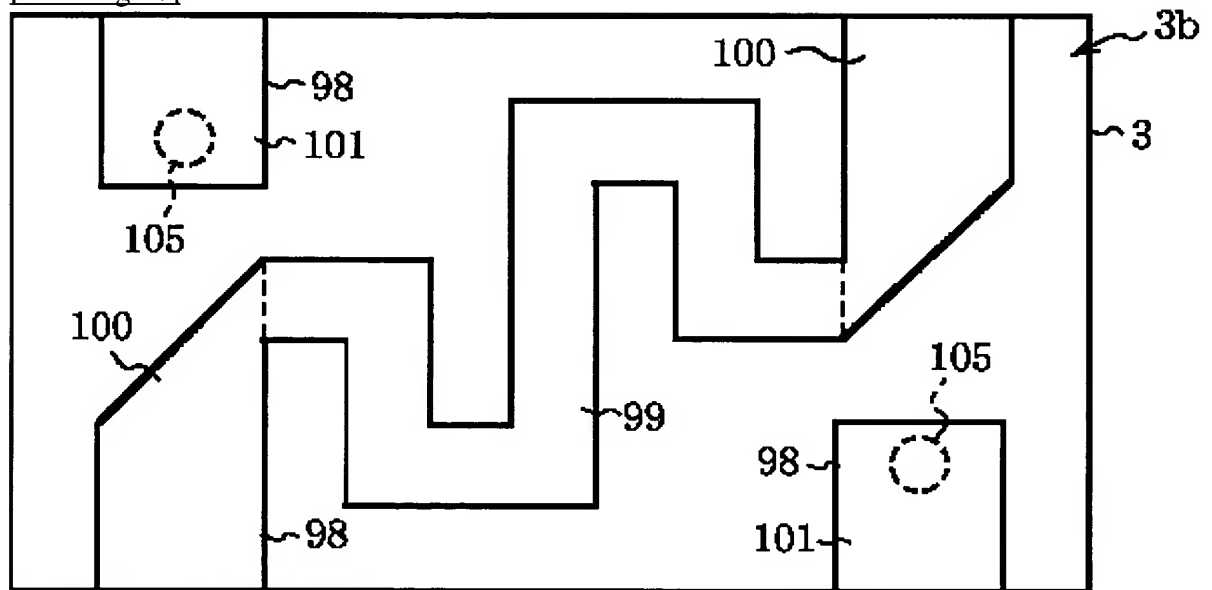
[Drawing 26]



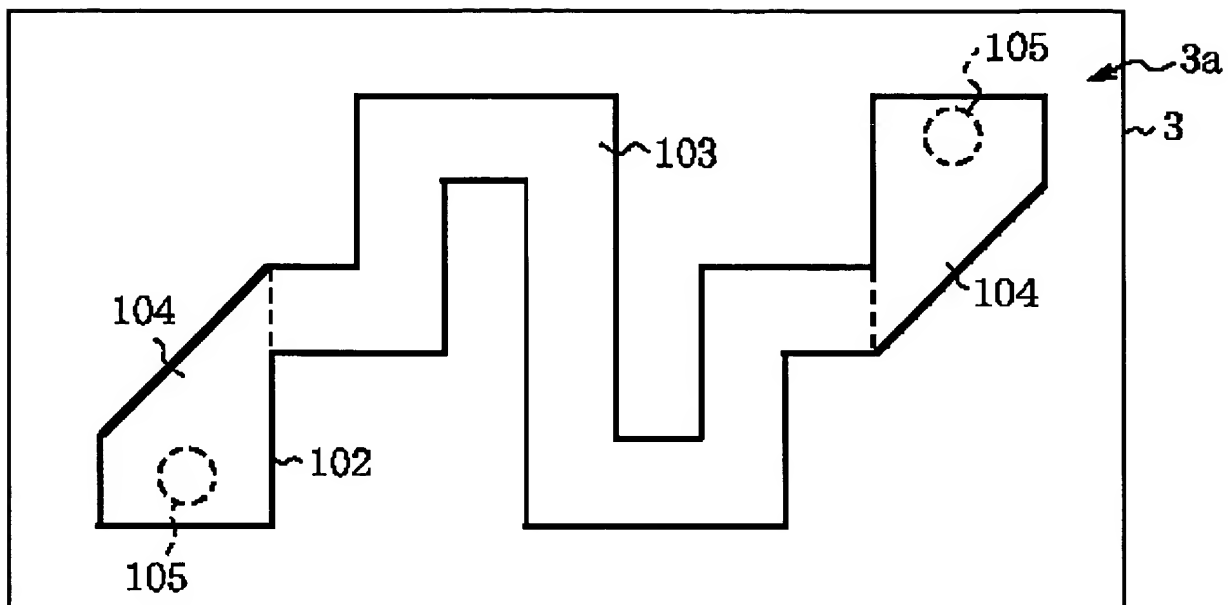
[Drawing 27]



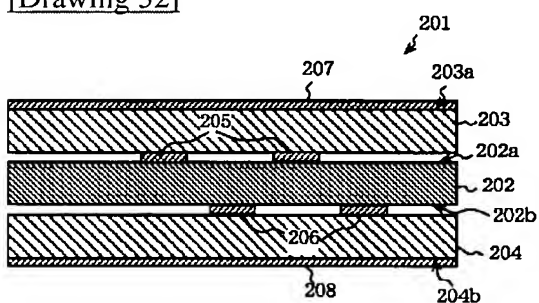
[Drawing 28]



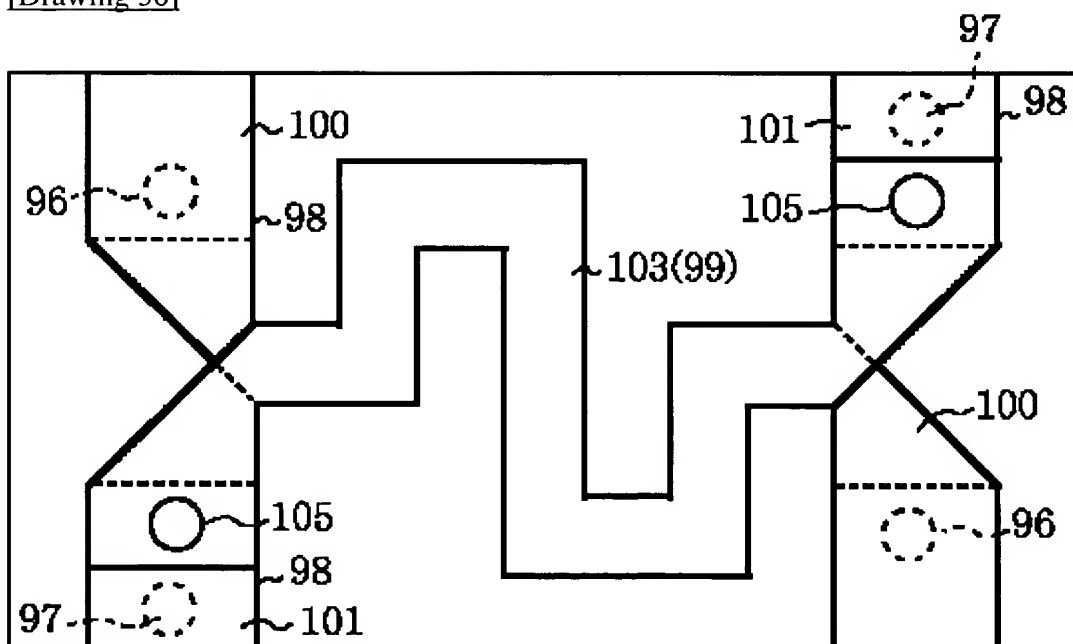
[Drawing 29]



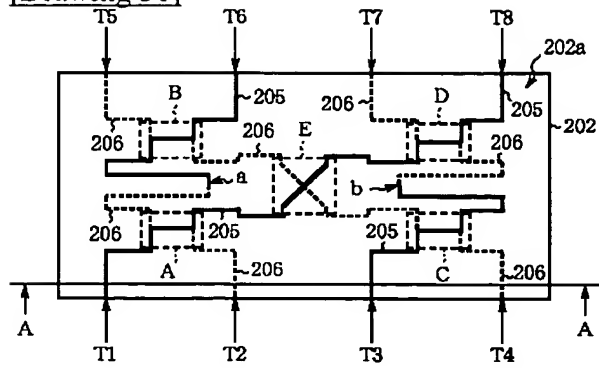
[Drawing 32]



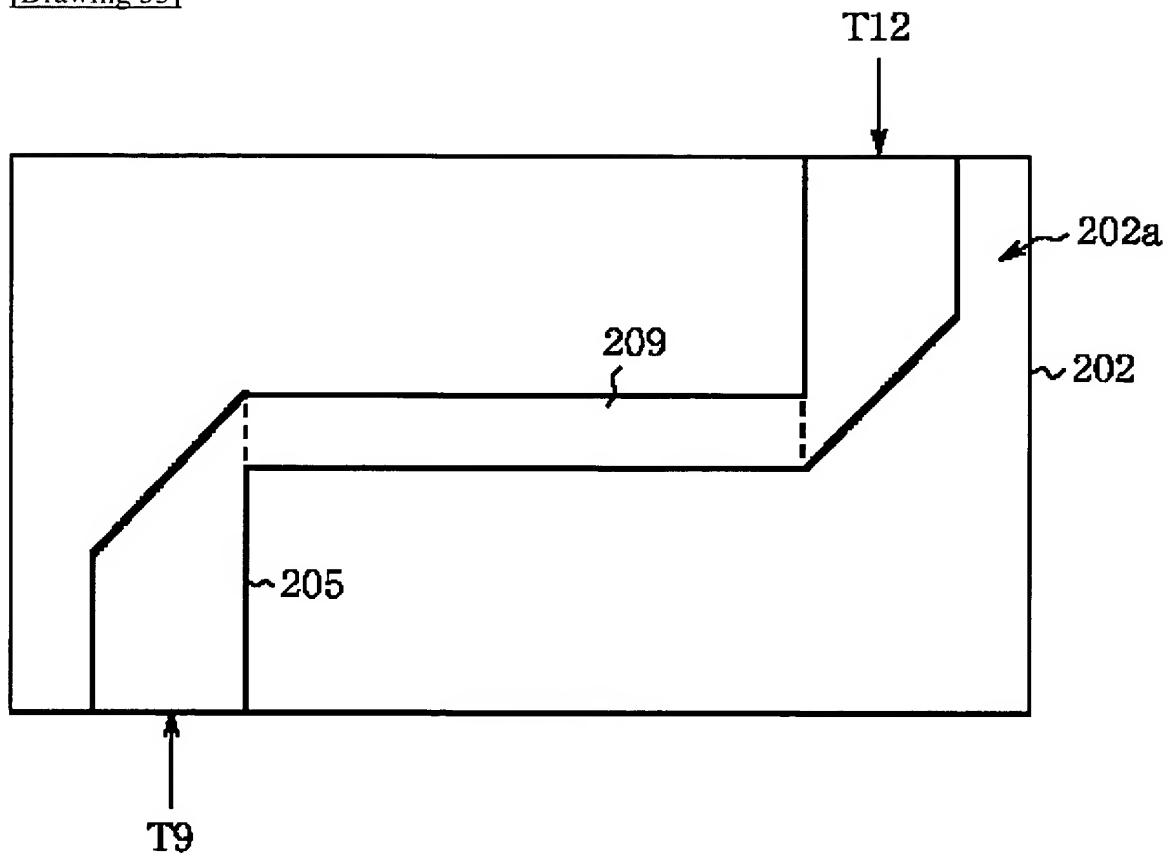
[Drawing 30]



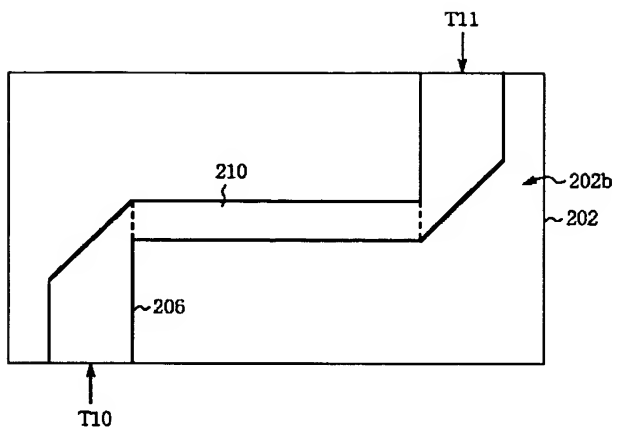
[Drawing 31]



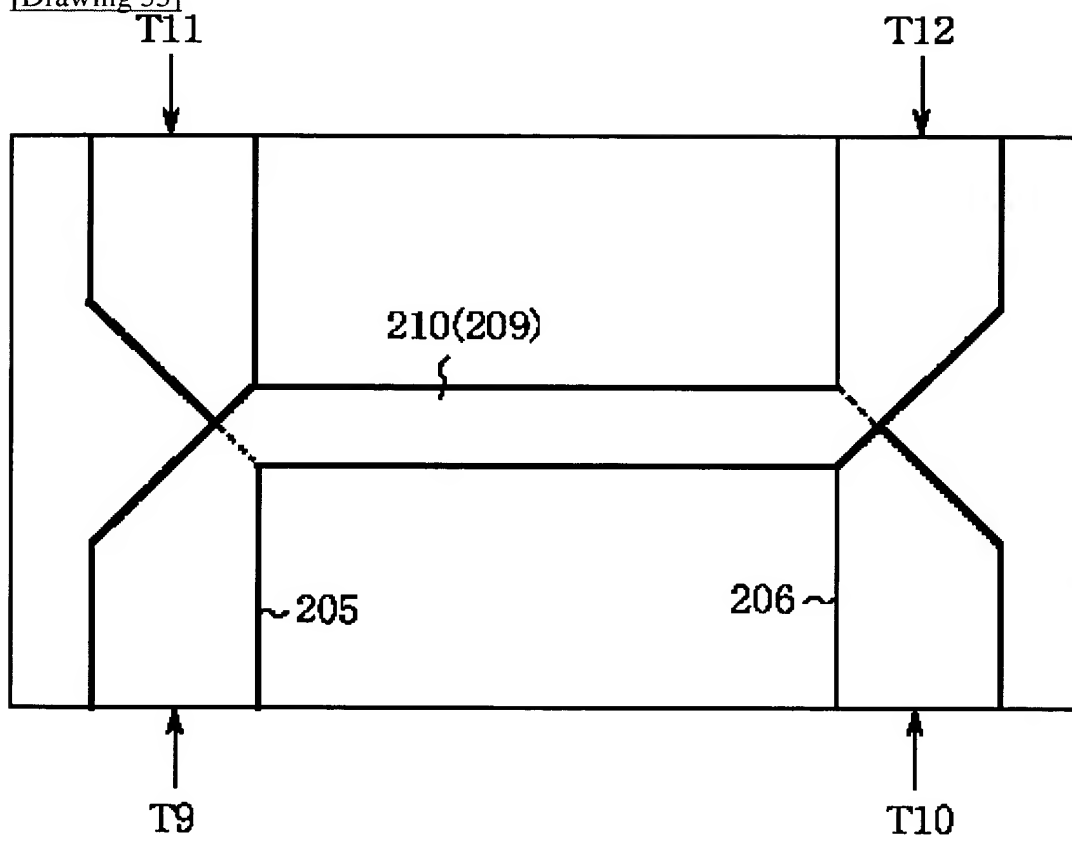
[Drawing 33]



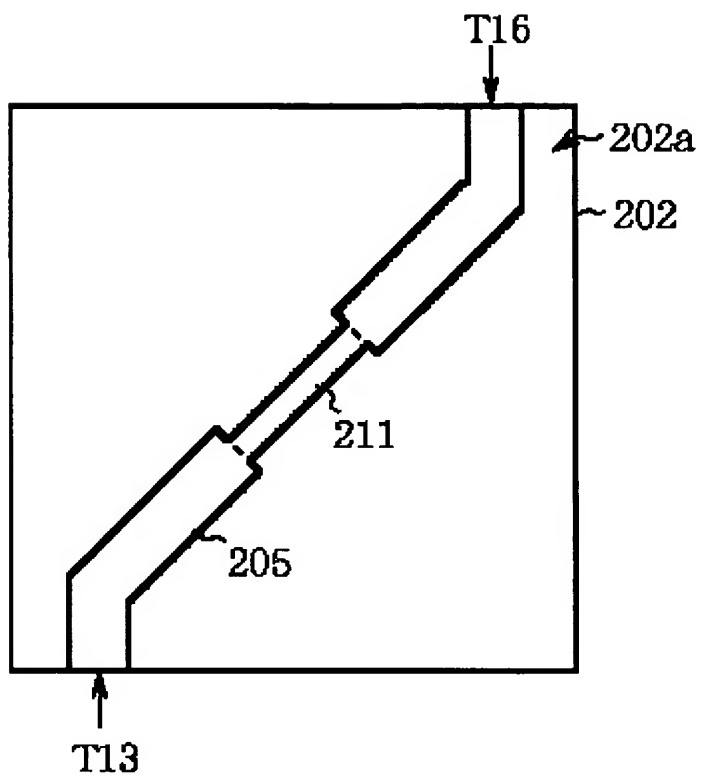
[Drawing 34]



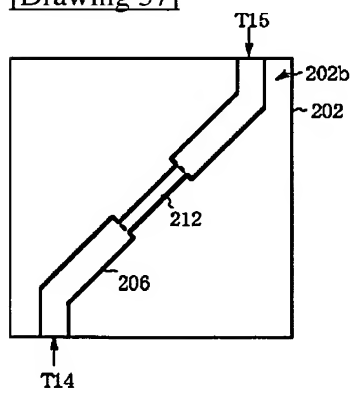
[Drawing 35]



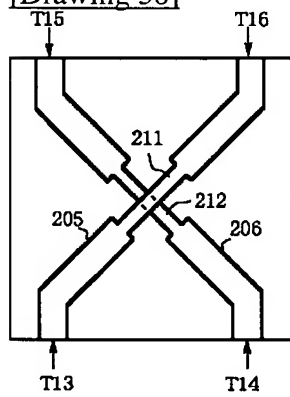
[Drawing 36]



[Drawing 37]



[Drawing 38]



[Translation done.]